AECOM Environment

Prepared for:
ArcelorMittal Indiana Harbor
East Chicago, IN

Prepared by:
AECOM
Milwaukee, WI
60157738
February, 2012

Clark Landfill RCRA 3013 Order Investigation Report

ArcelorMittal Indiana Harbor LLC.

RCRA Docket No. R3013-5-03-002
Site EPA ID No. IND-005-462-601

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CERTIFICATION

I certify that the information contained in or accompanying this submission is true, accurate, and complete [to the best of our knowledge].

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Executive Summary

The *Clark Landfill RCRA 3013 Order Investigation Report* was prepared pursuant to the United States Environmental Protection Agency (US EPA) Administrative Order (see Section 1.2). The groundwater investigation for the Clark Landfill (Group B) had been postponed pending completion of the closure (regrading and capping) of the landfill. This report provides the results of slag-fill/soil sampling and analysis, and a hydrogeologic conditions evaluation and groundwater sampling and analysis for the Clark Landfill, which are part of the ongoing monitoring program administered by the Indiana Department of Environmental Management (IDEM).

The Clark Landfill is located within the steel mill industrial complex with on-going active industrial operations. The landfill is located adjacent the north edge of an intake flume that conveys plant service water from Lake Michigan to the steel-making complex. This landfill itself was capped with a cobble size limestone (i.e., no soil or vegetation). The landfill final cover construction was completed in 2007 and final closure certification for the Clark Landfill was received from IDEM in December 2010. The landfill is currently in the post-closure monitoring period.

The proposed sampling at the Clark Landfill was included in the four sampling and analysis plans submitted in response to the RCRA 3013 order that were subsequently approved by US EPA. The approved scope of work for the Clark Landfill required four groundwater monitoring wells to be installed around the perimeter of the landfill. The four IDEM-approved boring/well locations were placed on the north, south, east and west periphery of the landfill to evaluate the nature of subsurface materials as well as to determine the groundwater flow direction. Slag-fill/soil samples and groundwater samples were collected from each of the four locations. The slag-fill/soil and groundwater samples were analyzed for the approved list of analytes that included volatile organic compounds, semivolatile organic compounds, metals and several general chemistry parameters.

Based on a review of the analytical information for the four subsurface slag-fill samples collected at Group B, the DQOs applicable to the subsurface were not exceeded in the slag-fill samples from the landfill monitoring wells. Therefore, no release has occurred and no further investigation is required for the slag-fill.

The groundwater data for the Clark Landfill indicates that groundwater flow is generally toward the south-southeast, toward the intake flume. Monitoring data collected since February 2010 indicates that these conditions are similar throughout the calendar year. Groundwater elevations typically vary between approximately 578 ft-msl and 580 ft-msl. The groundwater flow direction is influenced locally by the intake flume. Water from the intake flume is continuously withdrawn to provide water for the mill's various steel-making operations. The average horizontal hydraulic gradient at the Clark Landfill monitoring well locations ranges from approximately 0.0004 to 0.0009 feet per foot. The average groundwater flow is variable from 266 to 1359 feet/year. The hydraulic conductivities within the fill ranged from approximately 1.1×10^{-2} cm/sec to 3.8×10^{-1} cm/sec.

Only three constituents (benzene, arsenic and thallium) were detected above DQOs in the groundwater samples from the monitoring wells at the Clark Landfill. Benzene was detected in one groundwater sample above the IDEM MCL and slightly above the IDEM industrial default closure value in the sample duplicate. The well from which the sample was collected, MW-203S is immediately adjacent to the intake flume, but is also located in the downgradient direction of groundwater flow from the landfill. Because the well was completed within the rip-rap placed to protect the landfill from further slope failures, the water in the well is in close communication with the water in the intake flume. Based on this single sample event an evaluation of the significance of the DQO exceedance cannot be determined. Groundwater at the Clark landfill will be subject to post-closure monitoring and additional data will be collected for a further evaluation of the benzene detection.

Total arsenic above the industrial groundwater DQO was detected in two of four samples tested. Arsenic was not detected above the IDEM MCL or default closure DQO. Review of the filtered results indicates that the dissolved arsenic concentrations were 0.0018 and 0.0017 mg/L, respectively and these concentrations are less than the IDEM industrial DQO. Based on the results of the groundwater sampling data, the total arsenic concentrations in groundwater are well within the range of naturally occurring arsenic concentrations. Further, the dissolved arsenic groundwater concentrations are below the DQOs. Finally, based on the groundwater contour maps it appears that these two wells with are likely upgradient of the landfill. Therefore, the arsenic concentrations observed would not be attributable to the landfill.

Similarly, one thallium concentration was above the IDEM MCL in the total sample, but well below this DQO in the filtered sample. This thallium detection occurred at well MW-201S, which based on the groundwater contour maps is an upgradient well. Therefore, the concentration observed would not be attributable to the landfill.

In summary, one concentration of benzene was slightly above the DQO (IDEM Default Closure) in a duplicate sample but below the DQO in the primary sample. Additional sampling as part of the post-closure groundwater monitoring will be performed to determine if this concentration persists. The groundwater sampling has indicated the presence of low concentrations of arsenic (i.e., estimated concentrations below the reporting limit) in two upgradient wells and neither concentration was above the IDEM Default Closure value. Finally, thallium was detected slightly above the IDEM MCL at an upgradient well, but again did not exceed the IDEM Default Closure value. Therefore, no further investigation is required beyond the post-closure groundwater monitoring that will be conducted in conformance with IDEM-approved post-closure care of the landfill.

1.0 Introduction

The *Clark Landfill RCRA 3013 Order Investigation Report* was prepared pursuant to the United States Environmental Protection Agency (US EPA) Administrative Order (see Section 1.2). The investigation for the Clark Landfill (Group B) had been postponed pending closure of the landfill. This report provides the results of slag-fill/soil sampling and analysis, a hydrogeologic conditions evaluation and groundwater sampling and analysis for the Clark Landfill.

1.1 Site Location

ArcelorMittal Indiana Harbor LLC (IH) is located at 3001 Dickey Road in East Chicago, Lake County, Indiana. The properties consist of approximately 1,200 acres of land along the southern shore of Lake Michigan and the Indiana Harbor Ship Canal. The steel mill complex location can be further described as in Township 37 North, Range 9 West, Sections 9, 10, 15, and 16. Figure 1-1 provides a location map. The site is further depicted on an aerial photo provided as Figure 1-2 Site Layout.

The operations have been producing steel since the 1920s, with the earliest operations occupying the mainland areas of the property. The steel mill produces a variety of flat-rolled steel products. More than 80% of the steel mill complex is located on a peninsula extending northward into Lake Michigan. The peninsula was made from the controlled filling of the lake with iron and steel-making slag.

1.2 RCRA 3013 Order Project History

The steel making complex originally opened in the early 1920s as the Mark Steel Company. It was later operated by Youngstown Sheet and Tube Company (Youngstown, Ohio), Jones and Laughlin Steel Corporation (Pittsburg, Pennsylvania), and LTV Steel (Cleveland Ohio). In April of 2002, the International Steel Group, Inc. was formed and acquired the majority of the former LTV Indiana Harbor Works facility. The remaining portions of the former LTV Indiana Harbor Works facility were acquired by Tecumseh Redevelopment Inc. Subsequently the ISG and Tecumseh properties were acquired by Mittal Steel USA which more recently has merged with Arcelor and became ArcelorMittal Indiana Harbor, LLC and Tecumseh Redevelopment, Inc.

On October 23, 2003, the United States Environmental Protection Agency (US EPA) issued a RCRA Section 3013 Administrative Order (US EPA Docket No. R 3013-5-03-002) to IH and Tecumseh. The Order demanded both parties to prepare a proposal for monitoring, testing, analysis, and reporting to ascertain the nature and extent of hazards posed by hazardous wastes that are present or may have been released at 14 identified Units and one Area of Concern (AOC) at the facility (see below). IH and Tecumseh do not have information that indicates that hazardous wastes regulated by US EPA or the Indiana Department of Environmental Management (IDEM) are present or have been released at any of the 14 Units or the one AOC identified in the Order.

The 14 Units have been organized into eight Groups for the project based on proximity to one another and common operations. The Units are described below as shown in the Groups as follows:

Group	Unit Number	Unit Name	Unit Description	Unit Owner
A	1	Blast Furnace Filter Cake Pile	Solids removed from air scrubber, which are dewatered and recycled into the Sinter Plant.	IH
A	67	Sinter Plant	The sinter plant is a fully functioning part of the facility's operations. The sinter plant fuses fines and reclaimed fines for reuse in the blast furnaces.	IH
A	68	Sinter Plant Feedstock Piles	Piles of reclaimed fines for processing in the sinter plant.	IH
B	20	Clark Landfill	A facility landfill closed under an IDEM-approved closure plan.	IH
C	8	The Terminal Lagoon	A portion of a process water recycling facility.	IH
C	9	Terminal Lagoon Oil Skimmer Tank	The oil skimmer tank is a unit no longer in operation.	IH
C	10	Terminal Lagoon Sludge Pit	Water was drained from the Terminal Lagoon sludges back into the process water. The sludges were disposed as this practice ceased years ago.	IH
D	7	"The Hill"	Closed historic facility landfill.	IH
E	73	Old Quenching Area (Steel Slag Processing Area)	In the steel slag processing area of the facility, iron rich material is separated from slag for recycling.	IH
F	23	Filter Backwash Pile	A now-closed area that was used to drain water from solids trapped on the backwash filter.	IH
F	24	North Lagoon	An active NPDES permitted facility used for re-circulating process waters from the hot and cold rolling operations. Wastewater discharges to the lagoon have an NPDES permit and are monitored regularly.	IH
F	26	Old Oily Sludge Pit	An area on the south side of the lagoon that was used in the historic past to dewater sludge. This Unit is no longer in use.	IH
G	47	Wastewater Treatment Sludge Pile	Reportedly this area was used to stockpile wastewater treatment sludge outside of the Central Treatment Plant. The sludge has not existed for a number of years.	Tecumseh
H	65	Former Coke Plant Decanter Area	Reportedly located adjacent to the Indiana Harbor Shipping Canal. The coke plant was demolished in the early 1980's. Historic Sanborn maps depict coal piles on the land adjacent to the Indiana Harbor.	Tecumseh
H	AOC	Former Coking Plant No. 1	The former coke plant No. 1 is suspected of being a source of slag-fill/soil and groundwater impacts.	Tecumseh

The Proposal for monitoring, testing, analysis, and reporting for Units was contained in four work plans and a quality assurance project plan as follows:

- *Soil Sampling and Analysis Work Plan*, Volume 1 of 5, (Revision 2);
- *Sediment Sampling and Analysis Work Plan*, Volume 2 of 5, (Revision 2);
- *Hydrogeologic Conditions Work Plan*, Volume 3 of 5 (Revision 2);
- *Groundwater Sampling and Analysis Work Plan*, Volume 4 of 5, (Revision 2); and
- *Quality Assurance Project Plan*, Volume 5 of 5, (Revision 2)

These plans were prepared and subsequently approved by the US EPA on May 12, 2005. Field implementation of the work plans began shortly after US EPA approval. Slag-fill/soil boring advancement and the installation of groundwater monitoring wells occurred between March 14, 2005 and May 6, 2005 for all of the groups except for the Clark Landfill (Group B). The results of the work conducted under the approved work plans were presented in four reports:

- *Soil Sampling and Analysis Report* (Volume 1);
- *Sediment Sampling and Analysis Report* (Volume 2);
- *Hydrogeologic Conditions Report* (Volume 3); and
- *Groundwater Sampling and Analysis Report* (Volume 4).

1.3 Objectives of the Clark Landfill RCRA 3013 Investigation

The objectives of the Clark Landfill RCRA 3013 Investigation which have been completed were as follows:

- Characterized the subsurface slag-fill quality at the Clark Landfill (Group B) when groundwater monitoring wells were installed for post-closure monitoring;
- Evaluated potential pathways of migration and actual or potential receptors; and,
- Determined if a release had occurred and if any additional investigation was warranted.

1.4 Conceptual Site Model

The conceptual site model diagram for the Clark Landfill (Group B) was developed using examples provided in *Data Quality Objectives Process for Hazardous Waste Site Investigations*, US EPA QA/GWHW, January 2000. The Clark Landfill conceptual site model diagram was not designed to be used as human health or ecological risk assessment models, but serves to assist the site investigation process by designing sampling plans for site environmental media. The conceptual site model diagram illustrates the potential releases to environmental media, the potential exposure pathways for these environmental media and the potential receptors. The conceptual site model diagram is provided on Figure 1-3 and is discussed in Section 6.

2.0 Clark Landfill Description

Clark Landfill is located in the central section of the peninsula and occupies approximately 39 acres. The landfill had been used for over 20 years to dispose of steel manufacturing waste products including, but not limited to, basic oxygen furnace (BOF) dust and slag. The landfill is located adjacent the north edge of an intake flume that conveys plant service water from Lake Michigan to the steel-making complex. An application for an interim solid waste (non-hazardous waste) permit for the Clark Landfill was submitted to IDEM on August 29, 1989. However, IDEM did not issue a solid waste permit for the landfill. In May, 1996 the former owner indicated to IDEM its intent to discontinue the use of the landfill after May 1998 and withdrew its application for a solid waste permit. Waste disposal at the Clark Landfill ceased in March 1998. An amended permit application for closure of the Clark Landfill as a non-hazardous landfill was submitted to IDEM on July 30, 1999. The permit application includes, among other requirements, a groundwater sampling and analysis plan with the proposed installation of four monitoring wells, a closure plan, and a post-closure plan. This application was approved by IDEM on April 1, 2001. The landfill cover construction and quality assurance report for the Clark Landfill was submitted to IDEM on March 14, 2008. ArcelorMittal received final closure certification for the landfill from IDEM on December 15, 2010.

2.1 Landfill History

The landfill is constructed on general fill material that was placed in what once was Lake Michigan to create land on which the steel mill could be built. On August 6, 1997, the soft foundation clay underlying the general fill on which the landfill was constructed failed. The failure caused a portion of the toe of the landfill foundation to move both horizontally and vertically to the south and into water within the water intake flume. Slag and other foundation material that underlay the landfill moved into the water intake flume as a result of the failure. No waste material from the landfill was included in the material that failed into the water intake flume. The movement of the landfill foundation also allowed a portion of the landfill to drop into the void left by the movement of the foundation.

An approximate six-acre portion of Clark Landfill moved as a translation wedge block in a southerly direction to partially block the intake flume serving as the cooling water canal for the steel mill. The slide mass moved 30 to 50 feet into the canal and heaved the toe generally three feet above the waterline. On November 18 and 19, 1997, the flume was partially dredged, pursuant to permits issued by Indiana Department of Natural Resources and US Army Corps of Engineers, along the southern portion of its alignment to establish a deeper channel for long-term water passage.

The top of the landfill scarp had a maximum elevation (EL) of +670 feet and the bottom of the flume was at EL +555 feet (NGVD). Inclinometers and slag-fill/soil borings beneath the slide mass show the bottom of the translational slide plane of the central wedge block mass between EL +515 and +530 feet. A topographic survey in the late 1990s of the intake flume indicates Lake Michigan to be at EL +581 feet. Four temporary steel and plastic casings were installed during the week of May 4 through 9, 1998, within the limits of the landfill slide. The groundwater surface was measured to be at between EL +581 and +586 feet, with little to no mounding.

The landfill foundation slag fill is generally granular and pervious. Since the waste slide mass dropped 30 to 40 feet, there could be a portion of the pre-August 6, 1997 fill below the current groundwater table. The slide occupies approximately 400 feet of the intake flume and the slide mass extended approximately 30 to 50 feet into the intake flume. Therefore, it is estimated that between 11,000 and 18,000 cubic yards of fill, essentially in the center of the landfill and not in contact with the intake flume, is now potentially below the water table, whereas before August 6, 1997, it was above the water table. The slide mass that occupies the intake flume serves as a stability buttress and toe support.

2.2 Landfill Closure Activities

Landfill closure activities commenced subsequent to the failure of the supporting clay below the landfill. A geotechnical evaluation was conducted to determine the reason for the foundation failure and to identify actions necessary to stabilize the landfill. The failure had partially filled the water intake channel which provided water to the mill for all of the mill's process operations. The water intake channel required dredging to restore the size of the channel to its original dimensions. Activities conducted to address the failure and to prepare the landfill for closure were documented in the following reports:

- *Dredging of No. 2 Pumphouse Flume, Indiana Harbor Works, East Chicago, Indiana*. Submitted May 1, 2001.
- *Construction Documentation Report for the Clark Landfill Closure*, Submitted March 14, 2008
  - Section 2: Intake Flume Filling.
  - Sections 3 and 4, Landfill Mass Grading Phase I and Phase 2
  - Section 5, Landfill Cover

The intake flume filling was the first stage of the landfill closure. The filling was designed to buttress the toe of the existing Clark Landfill south slope against movement and to achieve a factor of safety greater than 1.3 for static slope stability. Approximately 116,200 tons of flume fill aggregate material (consisting of crushed limestone and dolomite) and 31,000 tons of limestone riprap was placed along the north side of the intake flume. Approximately 6,600 cubic yards of material from within the landfill were also relocated within the limit of waste in conjunction with the flume filling. An additional 3,700 cubic yards of waste was excavated from the east end of the landfill to accommodate the future slab hauler road re-alignment.

The second stage of landfill closure configured the surface of the landfill for capping. The re-grading was planned to improve stability of the landfill and provide positive drainage on all final cover slopes toward the perimeter of the landfill. The re-grading provided a means of isolating hard or bulky waste (that could endanger the final cover) at depths well below the upper waste surface. Waste was re-graded in accordance with the permitted waste grades, and included preservation of instrumentation and installation of a geomembrane liner and geocomposite drainage layer in limited areas adjacent to the flume prior to waste placement in those areas. Relocated waste materials were transported along roadways internal to the landfill and replaced within the waste footprint area. The material was placed in lifts and compacted with a smooth-drum roller. Field density tests were performed on the compacted fill using sand cone and nuclear density gauge.

A geomembrane liner systems consisting of 40-mil linear low density polyethylene (LLDPE) geomembrane overlain by a geocomposite drainage layer was designed for three areas adjacent to the flume. The geomembrane liner system was designed and installed to separate overlying waste from previously unfilled land along the Intake Flume. The geomembrane liner was sloped inward toward the center of the landfill. This geomembrane liner was subsequently exposed along its outer limit during the final cover system installation (described next) and the final cover geomembrane component was welded to the geomembrane liner.

A geomembrane liner was installed on the surface of the prepared subgrade. The geomembrane specified for this project was a nominal 40-mil linear low density polyethylene (LLDPE) textured geomembrane meeting the project specifications. A total of approximately 93,700 square feet of geomembrane, including minimum 4 inch overlaps, was installed during Phase 2 mass grading. Geomembrane panels were positioned by suspending rolls of LLDPE with an excavator or lift and unrolling the suspended material by hand as the loader remained stationary. The geomembrane rolls were 23 feet wide and had a typical length of 500 feet. Along the inside edge of the lined areas, the geomembrane panels were secured in an anchor trench. The anchor trench is generally 2 feet wide at the bottom by 2 feet deep, and the ends of the panels were extended down into and across the bottom of the anchor trench. Following placement of the geocomposite panel edges in the anchor trench, it was backfilled.

A geocomposite drainage layer was installed on top of the geomembrane. The geocomposite used for this project consisted of a geonet core with nominal 8 ounce per square yard (oz/yd^2) nonwoven geotextiles bonded to both sides. A total of approximately 93,700 square feet of geocomposite, including overlaps, was installed during Phase 2 mass grading.

The last phase of landfill closure was the installation of the landfill cover. The final cover design consisted of the following functional components (from top to bottom):

- Armor stone (with geogrid reinforcement on 3H:1V slopes);
- Storm water conveyance pipe network (north slope);
- Geotextile;
- Geomembrane; and
- Geocomposite (geotextile/geonet/geotextile).

An 18-inch thick layer of washed, open-graded, coarse crushed limestone aggregate was specified for the armor stone layer. This layer serves as an erosion-resistant layer that protects the underlying geomembrane from weathering, vegetation, burrowing animals, and maintenance traffic. The highly permeable armor stone also serves to drain precipitation off of the landfill cover. A geogrid reinforcement layer was installed near the base of the armor stone layer on the 3H:1V slopes located on the north and west sides of the landfill. The geogrid served to improve veneer stability of the armor stone on the underlying geotextile and geomembrane elements. In addition, a layer thickness of 24 inches was specified for the 3.5H:1V slope located on the south side of the landfill. The increased thickness provided increased hydraulic capacity in the lower portion of the slope. Approximately 1,774,000 square feet of geocomposite was installed during construction of the final cover.

A network of HDPE storm water collection pipe was installed on the north face of the landfill to collect storm water from the armor stone layer and quickly convey it to the perimeter drainage ditch located along the north and west toe of the landfill. Approximately 655,300 square feet of geogrid was used for final cover construction.

A 16-ounce/square yard nonwoven geotextile was specified between the armor stone and the geomembrane. This geotextile serves to cushion the underlying geomembrane from point stresses due to construction activities and the weight of the overlying armor stone. Approximately 1,774,000 square feet of geotextile was used for final cover construction.

A 40-mil LLDPE geomembrane textured on both sides was specified for the low permeability layer of the landfill cover system. The geomembrane serves to minimize infiltration of precipitation into the underlying waste. The 40-mil LLDPE will provide long-term durability, resistant to puncture, weathering, and differential settlement. The geomembrane was deployed in panels and field-seamed. Penetration boots were fabricated and installed at all penetrations (instrumentation risers and gas vents). Approximately 1,774,000 square feet of LLDPE geomembrane were installed during the construction of the final cover.

A geocomposite drainage product consisting of upper and lower 16 oz/yd^2 non-woven geotextile bonded to a HDPE geonet was specified beneath the geomembrane. The geocomposite has multiple functions. It provided a relatively smooth substrate over which the geomembrane could be deployed without puncture damage. It also serves to cushion the geomembrane from possible "hard-points" that might develop due to the heterogeneity of the near-surface waste fill. The geocomposite also serves to collect landfill gas that might be released from the upper surface of the waste fill and convey it to the gas vents. Approximately 1,774,000 square feet of double-sided geocomposite was installed during the construction of the final cover.

The landfill cover construction and quality assurance records for the installation are contained in the STS report *Construction Documentation Report for the Clark Landfill Closure*, which was submitted to IDEM on March 14, 2008. ArcelorMittal received approval of the final closure certification for the Clark Landfill from IDEM on December 15, 2010.

The landfill is instrumented with piezometers and inclinometers for monitoring slope stability. The piezometers and inclinometers were protected and monitored during the landfill cover construction. Post-closure monitoring will be conducted on a semi-annual basis and reports will be submitted to the Indiana Department of Environmental Management (IDEM). The slope stability monitoring indicates continuing improvement and that an adequate factor of safety has been achieved. According to the permit, the slope stability monitoring may be modified or deleted by IDEM. A reviewed by IDEM during the fall of 2011 suggests that this monitoring may be reduced to annual monitoring and deleted in two or three years if the current/improving trends persist.

3.0 Physical Setting

3.1 Topography

The Clark Landfill is located in the northwest portion of Lake County, Indiana on the shoreline of Lake Michigan on a man-made peninsula. The peninsula is bordered on two sides by Lake Michigan and one side by Indiana Harbor. The landward side of the peninsula is bordered by the east-west trending railroad grade. The ground surface of the peninsula is relatively flat and varies from +595 feet Mean Sea Level (MSL) to +600 feet MSL (Figure 1-1). The level of Lake Michigan is approximately 577 feet MSL. In the North Lagoon area, the groundwater elevation ranges from 1.5 to 9 feet above the water level of Lake Michigan.

3.2 Surface Water

Regionally, surface water flow is towards Lake Michigan, Indiana Harbor and Indiana Harbor Canal. On the Peninsula, however, surface water is collected via a combined process water/storm water collection system. All surface water is collected, treated and recycled by the combined process water/storm water collection treatment system or it is allowed to infiltrate into the ground. As an additional precaution to prevent surface water runoff off site, the perimeter of the Peninsula is diked.

Surface water around the Clark Landfill is collected in a perimeter drainage swale. The drainage swale is graded and drainage is directed to the Peninsula's combined process water/storm water collection system.

3.2.1 Lake Michigan Levels

Although the flow in the Indiana Harbor Canal is typically toward Lake Michigan, if water levels in Lake Michigan rise relative to those in the canal, backwater effects and flow reversals can occur. With no other outlets, normal flow accumulates within the canal until equilibrium between the lake and canal levels is re-established. Flow reversals are typically short in duration, whereas backwater (gradient) effects on water levels can persist for longer periods of time.

In addition to long-term lake level fluctuations, seiches (temporary buildups of lake water near the shore caused by local atmospheric pressure and wind) can cause short-term fluctuations of more than 3 feet within a few hours along the southern lakeshore. Long-term water level changes in Lake Michigan immediately affect levels in parts of Indiana Harbor and the canal, but seiche fluctuations are not fully transported upstream. Short-term seiche fluctuations are damped by the interaction of surface water and groundwater.

Lake Michigan levels recorded from six gauges in Lakes Michigan and Huron, and reported as a monthly average (in feet mean sea level) between 1960 and 2008, show a record low of 576.05 occurring in March 1964 and a record high of 582.35 recorded in October 1986. The data for 1996-2008 indicate that Lake Michigan levels are on the low side of normal ranging from a low of 576.38 in December 2008 to a high of 581.33 in July 1997.

3.2.2 Meteorology

The climate of northwestern Indiana is continental and is characterized by hot, humid summers and cold winters. The region received an average of about 37 inches of precipitation which includes 20 inches of snowfall annually (National Oceanic and Atmospheric Administration, 1992).

The nearest USGS precipitation recording station is located at Hobart, Indiana approximately 13 miles southeast of the site.

3.3 Regional Geology

Urban fill, consisting mainly of slag and dominated by sand and gravel size materials, has been deposited over the natural sands at the Lake Michigan shoreline to construct the peninsula. Filling began in the early 1900s under Indiana Code (4-18-13) which encouraged the building of artificial land along the Indiana shoreline using urban fill, primarily slag from the steel industry. The filling was generally completed by the mid 1960s. As of 1979, about 10 square miles of man-made land had been constructed along the southern shoreline of Lake Michigan.

Under the slag-fill are sand deposits of glacial or post-glacial origin. A sand, known as the Calumet sand, is generally present below the slag-fill except at the northernmost end of the peninsula where the sand thins to less than one foot in thickness. The Calumet sand varies in grain size from coarse to fine and the lower portion of the unit may be silty sand or silt. A succession of dense silts and clays containing occasional lenses of sand and gravel lies below the Calumet sands. The sediments are of glacial and lacustrine origin and are exposed to the south of the industrial/residential area extending southward from the Lake Michigan shoreline. These are referred to as the glacial clay till/lacustrine clay or clay unit. The top of the clay unit has been compacted in most places and can be locally weathered. Younger deposits overlie the clay unit, particularly in the northern Calumet Lacustrine Plain where eolian and lacustrine sands are predominant. Peat and muck are occasionally found close to the top of this unit. Silurian bedrock is found below the clay unit. A generalized geologic cross-section is also shown in Figure 3-1.

Silurian and Devonian limestones, dolomites, and shales directly underlie the unconsolidated glacial deposits across most of the region. The Devonian units include, from youngest to oldest, the Antrim Shale, the Traverse Limestone Formation and the Detroit River Limestone Formations. The Silurian age units consist of limestone and dolomite bedrock units. From youngest to oldest, they include the Salina Formation, Wabash Formation, Louisville Limestone, Salamonie Dolomite and Brassfield Limestone. These geologic units are depicted on a stratigraphic column in Figure 3-2. The erosional bedrock surface has about 70 feet of relief in the area and slopes gently toward Lake Michigan. Regional bedrock depths reported by the USGS range from 115 to 215 feet below grade (Fenelon and Watson, 1993).

The Lake County area of northwestern Indiana overlies the Kankakee arch bedrock formation, which has a bedrock high separating the Michigan Basin to the northeast from the Illinois Basin to the southwest. The bedrock is of Paleozoic age and consists of a succession of about 3,000 feet of sandstones, shales, and carbonates resting on older Precambrian granite (Hartke et al, 1975).

3.4 Site-Specific Geology

The slag-fill encountered on the Peninsula can be characterized as a granular material that ranges from fine sand to coarse gravel in size and from brown to black in color. The slag is medium dense to extremely dense as measured by standard penetration tests during drilling. The slag fill is approximately 52 feet thick at the end of the Peninsula near the Clark Landfill and extends to the top of the sediments that were formerly in Lake Michigan. The top of the Calumet sand and the top of the clay slope downward toward the lake. The thinning of the sand further out into the lake is consistent with normal near-shore environments in lakes. In the vicinity of the Clark Landfill, the Calumet sand ranges from one to four feet thick. Copies of the slag-fill/soil boring logs and well construction diagrams are included as Appendix A.

3.5 Regional Hydrogeology

Numerous studies of the regional hydrogeology have been conducted by USGS, Indiana State Geological Survey, and local industry. Approximately 87% of the total domestic water in Lake and Porter Counties is supplied by Lake Michigan. The remaining 13% is derived from groundwater and local lakes. Nearly all the groundwater is produced in the southern portion of these two counties from the Quaternary and Silurian-Devonian aquifers.

The shallow Quaternary aquifer in the northern portion of the region is not extensively utilized in the production of groundwater. Cambrian and Ordovician aquifers underlie the shallower aquifers but are not significantly developed in either county. The stratigraphic and hydrogeologic relationships of the aquifers are presented in Figure 3-3.

As shown in Figure 3-2 the Quaternary units overlie the Devonian (where present) and Silurian units. The Devonian units which produce groundwater include, from youngest to oldest, the Antrim Shale, the Traverse Limestone Formation and the Detroit River Limestone Formations. The Silurian age aquifers consist of limestone and dolomite bedrock units. From youngest to oldest, they include the Salina Formation, Wabash Formation, Louisville Limestone, Salamonie Dolomite and Brassfield Limestone. No known hydraulic connections between the Calumet Aquifer and the underlying bedrock aquifers are documented. The Calumet Aquifer is underlain by an aquitard comprised of low permeability clay and till. The following paragraphs describe each of these aquifers in greater detail.

Quaternary Aquifers – The Quaternary glacial deposits are separated into three aquifers; which are the Calumet, Valparaiso and Kankakee aquifers. Figure 3-3 illustrates the geographic and stratigraphic relationships between the three Quaternary aquifers.

Calumet Aquifer – The Calumet water table aquifer is exposed at the ground surface, except where urban fill is present, and is located in the northern portions of Lake and Porter Counties. It extends from Lake Michigan in a wedge shaped area encompassing the northern quarter of Lake County and northern tenth of Porter County. The Calumet aquifer is a beach deposit consisting of eolian and water-laid fine sands which yield good quality fresh water. The thickness of sand varies from 5 to 75 feet. An impermeable clay till is the basal unit of this aquifer.

Valparaiso Aquifer – The Valparaiso aquifer is partially confined. It consists of heterogeneous layers of sand and gravel with intermixed clay and silt lenses. Glacial till overlies and underlies the Valparaiso aquifer; however, it is known to crop out in some areas within the Valparaiso Morainal Plain. The aquifer ranges from 10 to 90 feet thick and is located 10 to 80 feet below the ground surface. Water quality is poorer than in the other two Quaternary aquifers.

Kankakee Aquifer – The Kankakee aquifer extends from the Valparaiso Moraine to the Kankakee River. This aquifer is composed primarily of sand, with some gravel and discontinuous silt and clay lenses. It is an unconfined aquifer which outcrops at the surface and is in hydraulic connection with the Valparaiso aquifer (see Figure 3-3). The Kankakee aquifer ranges in thickness from 10 to 50 feet with very good quality fresh water.

Silurian and Devonian Aquifers – The Silurian dolomite and limestone aquifers constitute the shallow bedrock aquifer system in Lake County. They are not in hydraulic connection with shallower Quaternary aquifers. These deposits dip to the east and crop out towards the west. The upper 200 to 300 feet of the carbonate bedrock system has been weathered and has solution features such as joints and fractures. This zone is the most productive with the shallow bedrock aquifer system. The depth to this aquifer increases from 15 feet in Kankakee Outwash Plain to 270 feet in the Valparaiso Moraine in Lake County. Water quality is generally good.

Cambro – Ordovician Aquifers – These aquifers underlie the Silurian-Devonian aquifers and have not been extensively developed due to the great depth to water and the marginal quality of the water.

Regionally, the uppermost aquifer is the Calumet Aquifer. The saturated thickness of the Calumet Aquifer ranges from 0 to 65 feet with an average thickness of 20 feet. The horizontal hydraulic conductivity of the aquifer within Lake County is estimated to range from 3.5×10^{-3} to 4.6×10^{-2} cm/s with an average of 2.1×10^{-2} cm/s (Rosenhein and Hunn, 1968). Other regional estimates of hydraulic conductivity for this aquifer range from 4.0×10^{-4} to 6.4×10^{-2} cm/s.

Because the basal clay unit of the Calumet Aquifer is laterally extensive and thick (55 to 75 feet) and has a vertical hydraulic conductivity of 10^{-7} to 10^{-8} cm/s, it serves as an aquiclude, effectively limiting vertical flow between the Calumet Aquifer above and the Silurian – Devonian Aquifer below. Hydraulic conductivities in the clay and till layer are on the order of 10^{-6} cm/sec or slower. Given the differences in hydraulic conductivity between the upper and basal portions of the aquifer and the vertically and laterally extensive nature of this deposit, the clay and till unit will retard the vertical migration of potentially impacted groundwater. Therefore, regionally the uppermost aquifer of interest is the Calumet Aquifer.

Within the region, the water table ranges in position from the land surface in low interdunal areas to 50 to 90 feet below ground in the higher dunes. It is generally less than 15 feet below ground through most of the region. Based on a map showing the potentiometric surface of the unconsolidated aquifer (Figure 3-4), regional flow is towards Lake Michigan. In general, groundwater is unconfined and mounded between the major surrounding surface water bodies, with the overall flow direction towards these surface water bodies. No major groundwater flow variations are observed in areas where flow is predominantly in the sand relative to areas where flow is predominantly in the urban fill (Baker, 1993; Fenelon and Watson, 1993).

The overall water balance for the Calumet Aquifer consists of inflow by way of rainfall and surface infiltration and outflow as discharge to local surface waters. A regional groundwater divide exists between Lake Michigan and the Grand Calumet River. Most of the groundwater within the region discharges to Lake Michigan or to the Grand Calumet River (Watson et al., 1989). USGS model simulations of regional groundwater flow have estimated that about 10 cfs discharges to the Grand Calumet River, 4 cfs to Lake Michigan along a 25-mile section of lakeshore in northwestern Indiana, and unquantified amounts to sewers or ditches (Fenelon and Watson, 1993).

4.0 Data Quality Assessment

The data quality assessment process is performed to determine if the performance criteria identified in the work plan and QAPP have been satisfied. The data quality assessment steps are described below. The results of the data quality assessment are included in Section 6.0.

4.1 Data Quality Objectives

The Data Quality Objective (DQO) Process is a series of planning steps designed to ensure that the type, quality, and quantity of environmental data used in decision-making are appropriate for the intended application. The general elements of the DQO process were presented in the Soil Sampling and Analysis Work Plan and various sections of the Quality Assurance Project Plan (QAPP). The DQO process is:

<u>Step 1) Stating the Problem.</u>

The US EPA has ordered slag-fill and soil sampling and analysis at ISG-IH and Tecumseh to aid in a determination as to whether hazardous wastes have been released from the Groups, and, if they have, the nature and extent.

<u>Step 2) Identifying the Decision</u>

The purpose of the slag-fill/slag-fill/soil sampling and analysis was to evaluate the slag-fill/slag-fill/soil conditions at the Groups. The initial sampling and analysis results were used to identify whether additional investigation should occur. Therefore, the proposed slag-fill/slag-fill/soil sampling and analysis was tailored to determine an answer to the following questions:

- What is the quality of the surface slag-fill or subsurface slag-fill/slag-fill/soil at the Groups?
- Do the results of analyses indicate there may be a potential human health and/or environmental exposure risk?
- Based on results of the sampling and analysis, is additional investigation necessary?

<u>Step 3) Identifying Inputs to the Decision</u>

Inputs to the decision include the results of laboratory analysis of slag-fill and native slag-fill/soil samples. The tabulated, validated analytical results are included on the sample results tables. These analytical data were evaluated on a per sample basis. The DQOs for the project include the numeric criteria listed below.

- IDEM Risk Integrated System of Closure (RISC) guidance (2001 with 2006 and 2009 updates) Table A-Default Closure Table-Industrial including both the migration to groundwater criteria and the industrial default closure criteria. Note that the industrial default closure criteria are the lowest values of the following: direct contact, migration to groundwater, construction worker, slag-fill/soil attenuation capacity or slag-fill/soil saturation.
- Region 5 US EPA Ecological Screening Criteria for soil (August 2003)
- National US EPA Ecological Screening Levels for specific metals including antimony, beryllium, cadmium, iron, and lead (November 2003).

- Direct comparison of analytical data to DQOs does not provide an accurate means of determining whether a release from a landfill site has occurred. The determination of groundwater impacts associated with the landfill is best conducted through statistical methods that compare downgradient and upgradient water quality. The IDEM groundwater quality monitoring program, which has not yet been finalized, will use these statistical comparisons to evaluate the data.

Step 4) Defining the Boundaries of the Study

The Administrative Order identified fourteen Solid Waste Management Units and one AOC. The Solid Waste Management Units and AOC identified in the Administrative Order have been combined into Groups where it was logical to look at more than one, investigatively. Eight Groups have been defined and for this report, Group B is the boundary of the study.

Step 5) Developing a Decision Rule

The decision rule is depicted on Figure 4-1. Figure 4-1 is the Decision Flow Chart for all of the activities proposed for response to the AO. As shown for surface slag-fill and subsurface slag-fill/slag-fill/soil, detected analytes will first be compared to the DQOs. If DQOs are met or exceeded, then an evaluation of the data will be performed to identify if the extent of impact has been defined. If the extent of impact has not been defined, then additional sampling and analysis may be recommended. Conclusions, if necessary, regarding the need for further risk assessment activities are presented in Section 7.0.

Direct comparison of analytical data to DQOs does not necessarily provide a means of determining whether a release from a landfill site has occurred. It should be recognized that data evaluation of landfill site will also include the statistical comparison of up and down-gradient water qualities. The IDEM groundwater quality monitoring program, which has not yet been finalized, will include both up-gradient and down-gradient monitoring wells and the use of statistical methods to develop background water limits. The determination of whether groundwater impacts associated with the landfill are present will be better gauged by this methodology rather than the direct comparison to DQO criteria.

Step 6) Specifying Limits on Decision Errors

Numerical limits on decision errors were not established for this project because prior data did not exist for the Clark Landfill for the constituents on the US EPA-required analyte list. Thus, these limits will be established during the statistical evaluation of the analytical data. This approach was used so that statistical analysis could be applied to evaluate the results against the DQOs and be able to calculate a limit on the decision error, if applied.

The overall goal of this RCRA 3013 investigation was to evaluate the subsurface slag-fill/slag-fill/soil and groundwater quality at the Clark Landfill (Group B). Since it would be impossible to completely avoid any decision error with 100% certainty, the project investigation scope was designed to provide a "best" estimate of conditions while avoiding unnecessary monitoring.

Step 7) Optimizing Design

The subsurface slag-fill/slag-fill/soil and groundwater sampling and analysis conducted as described in the work plan provided answers to the questions about the quality of the slag-fill and groundwater at the Clark Landfill. The sample locations identified in the work plan were accessible and the data was collected at well locations that will be used for monitoring of the closed landfill.

4.2 Preliminary Review of Data

Summary tables were prepared for the slag-fill/slag-fill/soil and groundwater data. The DQOs are depicted on the tables. 100% of the laboratory analytical data was validated. Validation procedures are described in Section 5.9. The results of data validation are incorporated into the summary tables by the addition of qualifiers where needed. The results of the data validation are provided in Section 6.1 for slag-fill and 6.4 for groundwater. Statistical analysis of groundwater samples will be conducted for the post-closure groundwater monitoring program.

4.3 Drawn Conclusions from the Data

The conclusions drawn from the data are included in Section 7.0.

5.0 Field and Laboratory Procedures

The methods and procedures for conducting the RCRA 3013 investigation at the Clark Landfill include procedures describing the advancement of slag-fill/soil borings, the sampling of subsurface slag/fill for laboratory and physical testing, the installation of groundwater monitoring wells, the sampling of groundwater for laboratory testing, the measurement of depth to water and hydraulic conductivity testing.

5.1 Sample Locations

Four slag-fill/soil borings were advanced for monitoring well installation. The boring/well locations were placed on the periphery of the landfill on the north, south, east and west sides of the landfill to evaluate the nature of subsurface materials on each side of the landfill as well as to determine the groundwater flow direction. The monitoring well locations are depicted on Figure 5-1.

Slag-fill/slag-fill/soil samples for analytical testing and grain size analysis were collected during boring advancement. Surface slag-fill samples were not collected because the top two feet at the Clark Landfill are composed of clean limestone used for capping. The four borings were completed as groundwater monitoring wells screened across the water table.

5.2 Borehole Drilling

Slag-fill/soil borings were drilled at each well location prior to groundwater monitoring well installation using hollow stem augers advanced by a truck mounted auger drilling rig. Continuous flight augers having hollow stems were used to advance the bore holes. The hollow stem augers had an 8-inch outside diameter and a 4 ¼-inch inside diameter. Slag-fill sampling and well construction were completed inside the hollow stem augers.

5.3 Slag-fill Sampling Procedures

Slag-fill/slag-fill/soil samples were collected by a split-spoon sampler using the following procedures.

1. Cleaned out the borehole to the sampling depth, being careful to minimize the chances for disturbance or contamination of the material to be sampled.
2. Assembled the split barrel sampler onto drill rods and lowered into the drill hole.
3. The 2-inch OD split-barrel sampler was driven with blows from a 140-pound hammer falling 30 inches in accordance with ASTM D 1586-84, Standard Penetration Test.
4. Repeated this operation at intervals not longer than two feet.
5. Recorded on the boring log the number of blows required to effect each 6 inches of penetration or fraction thereof. The first 6 inches was considered to be a seating drive. The sum of the number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N. (If less than one foot is penetrated, the logs state the number of blows and the fraction of one foot penetrated.) Refusal of the standard penetration test was noted as 50 blows over an interval equal to or less than 6 inches; the interval depth driven was noted along with the blow count.
6. Retrieved the sampler to the surface and removed both ends and one half of the split-spoon sampler such that the slag-fill/soil recovered rested in the remaining half of the barrel. Described

carefully the recovery (length), composition, structure, consistency, color, condition, etc. of the recovered slag-fill/soil.

7. Filled sample containers in the order described in the *Soil Sampling and Analysis Plan*. Samples for VOCs were taken first from an undisturbed (if possible) discrete area of the sample. The remaining slag-fill/soil was mixed thoroughly before filling the remaining sample containers so that the sample was as representative of the depth interval as possible. Jars with samples not taken for chemical analysis were tightly closed, to prevent evaporation of the slag-fill/soil moisture.
8. Affixed labels to the jars and completed chain-of-custody and other required sample data forms. Protected samples against extreme temperature changes and breakage by placing them in appropriate ice-filled coolers or cartons stored in a protected area.
9. Recorded all pertinent sampling information such as slag-fill/soil description, sample depth, sample number, sample location, and time of sample collection in the Boring Log. In addition, labeled and numbered the sample bottle(s).
10. Placed the samples in a cooler on ice. Made sure that chain of custody forms and sample request forms were properly filled out and enclosed or attached. Transported the samples to the laboratory or transferred samples and chain of custody to lab courier.
11. Decontaminated the split-spoon sample as described in Section 5.4. Replaced disposable gloves between sample stations to prevent cross-contaminating samples.

Borehole lithology and well construction details are provided on a bore log and well construction diagram which are included as Appendix A. The slag-fill/soils were classified by a site geologist. The slag-fill/soil descriptions include: slag-fill/soil grain size with appropriate descriptors; color; relative density and/or consistency; moisture content; stratification; texture/fabric/bedding; or other distinguishing features, as appropriate. These descriptors were evaluated and the slag-fill/soils classified according to the USCS. Fill materials do not have a USCS classification. Table 5-1 is a list of visual and olfactory observations made during drilling.

Subsurface samples were field-screened using a photoionization detector (PID) on a separate portion of the collected samples if sufficient volume was obtained for the sample interval. The meter was used and calibrated at least once daily to 100 ppm isobutylene in air. The field screening was conducted by measuring the headspace above the sample jar retained for lithology description after the sample had equilibrated in the jar.

Sampling equipment was decontaminated in accordance with procedures specified in Section 5.7.

5.4 Monitoring Well Installation and Development

Monitoring wells were constructed inside the drill string after the desired depth of the well had been reached. The water table monitoring wells were constructed with a ten-foot long well screen to intersect the water table and to account for water table fluctuations (i.e. approximately four feet of screen above the water table and six feet below). The wells were constructed with new PVC casing and well screen, two-inches in diameter. The well screen was factory cut slot at 0.010-inch per slot. The filter pack extended one to two feet above the top of the screen and a fine sand seal was placed above the filter pack.

The remaining annular space was sealed with coarse, chipped (or granular) bentonite to within one-foot of the ground surface. A protective pipe and concrete surface seal completed the installation. To protect the monitoring wells from vehicular traffic, several bumper posts were installed adjacent to the monitoring wells at each location. The four-inch diameter posts were buried at least three feet into the ground and sealed into place with concrete. Highly visible yellow safety paint was applied to the posts for additional protection.

The monitoring wells were developed after the well was installed by surging and purging techniques. Surging created alternating negative and positive pressure on the water column forcing entrained solids in the filter pack into the water column. Remaining suspended solids purged from the well using a submersible pump until the development water cleared, five well volumes of groundwater were removed, or field parameters stabilized. Well development field data is provided in Appendix B.

5.5 Groundwater Sample Procedures

Groundwater sampling procedures include procedures for water level measurement, groundwater sampling for lab analysis and hydraulic conductivity testing.

5.5.1 Groundwater Level Measurements

Water levels in groundwater monitoring wells were measured with an electronic water level indicator from a measuring point scribed into the top of the monitoring well riser pipe. Water levels were measured by lowering the probe into the well until the device indicated that water had been encountered, usually with a constant buzz and a light. The groundwater level was recorded to the nearest 0.01 foot using the graduated markings on the water level indicator tape. This measurement, when subtracted from the measuring point elevation, yielded the groundwater elevation. The measured groundwater levels and calculated elevations are provided on a table and hydrographs are provided on a figure.

Groundwater flow gradients are calculated from the groundwater elevations and the distance between wells along the groundwater flow direction. Groundwater gradients were calculated for representative months for two well pairs along the flow path. Copies of the calculations are included as Appendix C.

5.5.2 Groundwater Sample Collection

Groundwater samples were generally collected using a peristaltic pump. The procedure used to sample the well with the peristaltic pump included the following steps:

1. Covered the area around the base of the well with plastic to protect the sampling equipment from surface slag-fill/soil contamination.
2. Opened the well and permitted the water level to equilibrate to atmospheric pressure.
3. Set up and measured the appropriate length of new disposal sample tubing. Inserted new silicone tubing into the pump head of the peristaltic pump.
4. Set up the flow-through cell to measure groundwater field parameters and calibrated the measurement equipment (pH, temperature, conductivity, ORP, and turbidity)
5. Measured the depth to groundwater.
6. Lowered the disposable tubing into the well so that the bottom of the tubing was at the approximate center of the saturated interval within the well.
7. The pump was turned on and purging began at a flow rate such that the water level of the well remained near its static water level. This prevented cascading of the water down the well screen, so that aeration of the water sample did not occur. The flow rates were typically 100 to 400 milliliters per minute (ml/min). Wells with lower transmissivity were purged and sampled at a lower flow rates (300 ml/min or less)
8. Documented the measured field parameters, pump rate and groundwater level every three minutes. When three consecutive readings were within acceptance criteria, the well was

considered ready for sampling. If the well purged dry, groundwater sample collection began as soon as the well had recharged sufficiently to collect a sample. If non-aqueous phase fluids (free product) were present one to three well volumes were purged prior to sampling as determined by the ability to obtain water below the free product without free product becoming incorporated into the sample. If the well produced water very slowly and could be purged dry groundwater was sampled after the well recovered sufficiently to resume pumping. In these cases, the field readings were taken immediately before sampling and recorded on the field sampling sheet.

9. Conducted sampling by filling each laboratory-supplied, pre-preserved container in the following order: VOCs, SVOCs, PAHs, TOC, other inorganic parameters, total metals and lastly dissolved metals. The metal samples were field filtered for dissolved metal analysis.

Groundwater sampling field sheets are provided in Appendix D.

5.5.3 Groundwater Analytical Considerations

The US EPA Region V QAPP guidance (April 1998) recommended some modifications to sampling and analysis based on Region V's experience with sampling at other steel mills. Some of the specific recommendations incorporated into the groundwater sampling events included:

- Elevated concentrations of calcium in the groundwater can react with acid, efflorescing and losing volatiles during the reaction. Thus, VOC samples were not preserved with acid.
- If the alkalinity is greater than 1,000 milligrams per liter, more than 10 milliliters of nitric acid may be required to preserve the groundwater samples. Elevated alkalinity was not observed in the Clark Landfill groundwater samples.
- The laboratory used zinc acetate as well as sodium hydroxide for preservation of total sulfide samples to offset the effect of elevated pH and low dissolved oxygen.
- Samples for cyanide were not preserved with sodium hydroxide if the pH of the groundwater was greater than 11 at the time of sample collection.
- The laboratory used a reagent to check for sulfide interference prior to the cyanide analysis; and, if present, modified the procedure to adjust for the interference.

5.5.4 In-Situ Hydraulic Conductivity Testing

Hydraulic conductivity testing was conducted at the four monitoring wells to evaluate the hydraulic conductivity in the immediate vicinity of the landfill. The rising head method was used to evaluate the hydraulic conductivity. The rising-head test imposed a stress on the water bearing layer by instantaneously depressing the water surface and measuring the rate of water level recovery to equilibrium conditions. The water level was depressed by extracting a volume of water (e.g. removing a full bailer) or by using a pneumatic well manifold and inert nitrogen gas. The rate of water recovery was measured using a pressure transducer and data logger. One to three replicate tests were conducted on each monitoring well tested. Copies of the field data collected during the slug tests (both manual and transducer) are included as Appendix E.

Hydraulic conductivity values for each well were calculated using the Bouwer and Rice method (1976) in a readily available computer program (AQTESOLV Version 3.01.004 2000). Copies of the graphical output are also included in Appendix E.

5.6 Slag-fill/soil and Groundwater Sampling QC Procedures

Quality control (QC) samples included the following:

- field duplicates collected at a frequency of one for every 10 samples,
- matrix spike/matrix spike duplicate (MS/MSD) samples - one MS/MSD sample pair per 20 analytical samples,
- trip blanks per cooler or per shipment to the lab, and
- laboratory method blanks

These samples were collected as described below:

Field duplicates – Field duplicates were collected at the same time as the groundwater sample was collected from the well. The field duplicate samples were analyzed for the same analytes as the groundwater samples.

Matrix Spikes/Matrix Spike Duplicate – MS/MSD provide information about the effect of the sample matrix on the digestion and measurement methodology. Matrix spikes were performed in duplicate and are referred to as MS/MSD samples. MS/MSD analyses were conducted at a rate of one MS/MSD per 20 analytical samples in the laboratory batch. Sufficient volume for analysis of MS/MSD samples were collected and provided to the laboratory at a rate of one per 20 samples for the total number of project samples.

Trip Blanks – Trip blank samples were analyzed for VOCs only as a measure of potential permeants into the VOC water samples. Trip blank samples accompanied each batch of samples at a rate of one trip blank per day or per cooler whichever was less.

Method Blanks – Method blanks were generated within the laboratory and used to assess contamination resulting from laboratory procedures. A method blank was run with each sample QC Procedures

5.7 Decontamination Procedures

Field analytical equipment that came in direct contact with the sample or sample media was decontaminated before and after use, according to the procedures outlined below, unless manufacturers' instructions indicated otherwise.

1. Cleaned with tap water and laboratory detergent using a brush, if necessary, to remove particular matter and surface films.
2. Rinsed thoroughly with tap water.
3. Rinsed thoroughly with distilled de-ionized water and allowed to air dry.

5.8 Data Validation

The purpose of the validation was to evaluate the analytical data in terms of certain prescribed criteria in order to assess the quality and usability of the data. During the validation process, each analytical result was flagged by a letter qualifier or combination of qualifiers that indicated the usability of the result as necessary. For example, a "J" qualifier indicates that a result is usable, but represents an estimated value for the reason(s) given in the validation narrative. An "R" qualifier indicates that the result is rejected for the reason(s) stated in the narrative, and is therefore not a usable data point for the purposes of site characterization or a risk assessment. The following qualifiers were used during data validation and the corresponding definitions:

J Estimated value, detected concentration between the method detection limit and the quantitation (or reporting) limit

M+ Result biased high due to matrix effect
M- Result biased low due to matrix effect
M Result biased due to matrix effect, concentration is estimated
B Analyte detected in the laboratory method blank.
E Estimated value, hold time exceeded
R Result is rejected and unusable

These qualifiers were modified from the standard qualifiers defined in the US EPA CLP National Functional Guidelines (Organic 1999 and Inorganic 2004) because for all of the biased samples, the guidelines simply flag with a "J" for "estimated concentration": For our use of the data and to reflect on what basis the concentration was estimated we chose to depict sample analyses experiencing a matrix effect by differentiating the qualifier from J to M as shown above.

In addition to determining data quality and usability, the information derived from the data validation process also aids in assessing the percent completeness of the data set. Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project.

The validation of analytical data was performed by AECOM. Validation consisted of a review of the following criteria:

- Sample/extract holding times
- Initial and continuing calibrations
- Blanks
- Surrogate spike recoveries
- MS/MSDs recoveries and %RPDs (for the MSDs)
- MS recoveries and duplicate %RPDs for inorganics
- LCS recoveries and %RPDs
- %RPDs for field duplicates
- Internal standards performance
- Organic compound identification and quantitation
- Reported detection limits
- System performance

The results of the data validation are provided on data summary tables which include validation-qualified data.

- Data validation summary and narrative (Sections 6.1 and 6.4)
- A summary of samples and fractions reviewed (Sections 6.1 and 6.4)

All laboratory analytical data (100%) was validated.

6.0 Results and Analysis

The laboratory analytical results conducted on the slag-fill and groundwater samples included 29 volatile organic compounds (VOCs), 40 semivolatile organic compounds (SVOCs), 16 polynuclear aromatic hydrocarbons (PAHs), 19 metals and several general parameters including total cyanide, sulfide and total phenolics. Groundwater samples were analyzed for an additional 5 metals and several general chemical parameters including alkalinity, ammonia, chloride, COD, hardness and TOC.

The DQOs listed in the *Soil Sampling and Analysis Plan* included in this report are the IDEM industrial migration to groundwater, IDEM default closure criteria as well as the US EPA ESLs. In addition to the DQOs listed in the *Soil Sampling and Analysis Plan,* the data are evaluated against the IDEM construction worker and the soil direct contact criteria. Both the IDEM construction worker and direct contact criteria are considered screening criteria. The DQOs and screening criteria may not be necessary or applicable for comparison to the analytical results for all samples. Direct contact screening criteria were not applied to the samples collected below a depth of two feet. Therefore, direct contact with subsurface slag-fill is no longer a concern except potentially to a construction worker, which is a covered by a separate category with its own criteria. Similarly, comparison of US EPA ESLs (ecological screening levels) to results for slag-fill samples collected appreciably below the surface also appears inappropriate since these areas are outside of the zone(s) these vertebrates/invertebrates would be expected to inhabit.

The DQOs listed in the *Groundwater Sampling and Analysis Plan* are used in this report to evaluate the groundwater quality and include the IDEM groundwater solubility, IDEM MCL, industrial groundwater and industrial default closure. When evaluating the groundwater data, the reviewer is cautioned that it is important to remember the basic definitions of the commonly used reporting limits. Results reported below the MDL are regarded as non-detect and results above the MDL are regarded as detections. However, detected results can be further categorized as reported above or below the reporting limit (RL). Values reported between the MDL and the RL are flagged with a "J" value indicating that the concentrations are estimated. Although the analytical laboratory may be able to identify a constituent and report a concentration, the value cannot be properly quantified (i.e., measured within specified limits of precision and accuracy). Consequently, the true concentration of data reported below the RL is not accurately known. Since the concentrations are not accurately known, conclusions should not be drawn on whether these criteria are greater than a specified DQO and/or criteria. As part of the continuing obligations for the Clark Landfill, groundwater monitoring will be continued and confirmation of any detected analytes will be conducted.

6.1 Slag-fill Analytical Results

Surface slag-fill samples were not collected because Group B (Clark Landfill) is a limestone capped landfill and the top two feet are cap. Slag-fill samples were collected from the two foot zone above the water table at locations MW-201S, MW-202S and MW-204S. A second sample in the saturated zone near the water table interface was also collected from MW-201S because of odor and discoloration. Slag-fill samples were not collected from MW-203S located adjacent to the intake flume because slag-fill was not obtained during split spoon sampling, nor were cuttings generated during the installation of the monitoring well.

6.1.1 Group B Slag-fill Data Validation Results

The laboratory analytical results for the Clark Landfill slag-fill samples were provided in two laboratory sample delivery groups. The lab data was validated and found to be 100% complete. The slag-fill analytical results have been tabulated, validated and qualified on Table 6-1. The data validation is discussed below in Section 6.1.1.2. A copy of the laboratory analytical reports and the Level IV QC data package is contained on a CD in Appendix G. All data was acceptable and is considered usable.

Four slag-fill samples collected from three borings were analyzed by Microbac, for the analytes and methods shown on below. The methods used by the laboratory were those approved in the project Quality Assurance Project Plan.

Analysis	Method
Total Cyanide	9012B
Total Organic Content	D2974-87_C
Volatile Organic Compounds	SW5035/8260B
Total Metals by ICP/MS	SW6020A
Hexavalent Chromium	SW7196A
Total Mercury	SW7471A
SVOCs w/Low Level PAHs	SW8270C
Total Sulfide	SW9030B MOD
Total Phenolics	SW9066

6.1.1.1 Group B Slag-fill Data Completeness Assessment

The Microbac data packages received were complete. All samples listed below that were submitted and indicated for analysis were analyzed. The following data packages are included in the review of the Group A slag-fill/soil results.

Lab Work Order #	Sample Location and (Depth)
ME0911644	MW-204 S (14-16), MW-201S (14-16) and (22-24)
ME0911730	MW-202S (14-16)

6.1.1.2 Group B Slag-fill Data Compliance Assessment

Holding Times/Preservation

Submitted samples were received on ice in sample containers preserved as appropriate. Samples were extracted and analyzed within the method-required holding times. No action was needed to qualify sample data based on holding times.

Initial Calibration Verification (ICV)/Continuing Calibration Verification (CCV)

Initial and continuing calibration and calibration verification were conducted in general conformance with method requirements. The calibration and continuing calibration data met the required control or recovery limits. No action was needed to qualify sample data based on calibration data.

Laboratory Blanks

Laboratory blanks were prepared and extracted with the method-required frequency per laboratory batch of 20 samples or less. The Laboratory Work Orders with detected analytes in the method blanks are shown below. The concentrations detected in the samples were usually much greater (more than 10X) the concentrations detected in the blanks. However, a "B" qualifier was used to denote those samples/analytes which had been detected in the laboratory blank and the sample concentration was less than or equal to 5X the blank concentration. The table below identifies the qualified samples, the analyte and the blank concentration for that analyte.

Sample Location	Laboratory Order No.	Analyte Detected in Blank
MW-201S (14-16), MW-201S(22-24), MW-294 (14-16)	ME0911644	Mercury at 0.014 mg/kg Tin at 0.527 mg/kg Copper at 0.002 mg/kg
MW-201S(22-24)	ME0911644	Cadmium at 0.0009 mg/kg
MW-202S (14-16)	ME0911730	Mercury at 0.0123 mg/kg Tin at 0.667 mg/kg

Surrogate Recoveries

Surrogate recoveries were within acceptance criteria for percent. The data reviewed was of acceptable quality. None of the data required qualification due to surrogate recoveries

Matrix Spike/Matrix Spike Duplicate Samples

MS/MSD sample analyses were conducted on the slag-fill sample from MW-201S (14-16). The mercury result for the MS/MSD met accuracy criteria, but was outside acceptance criteria for precision. A post digestion spike was within the acceptance criteria. The MS/MSD sample results may have been biased by the mercury present in the sample blank and further qualification of the mercury results are not necessary. Cadmium, chromium and selenium concentrations of the samples in the affected analytical group were qualified with an M for matrix effect because the post digestion spike did not meet the RPD criteria.

The MS/MSD SVOC analyses on the slag-fill sample from MW-201S (14-16) resulted in high recoveries for 9 analytes. Of these 9 analytes, only two were detected the samples, acenaphthene and pyrene. The samples in the affected analytical group with detected concentrations were qualified with an M+ to indicate the results may be biased high.

MS/MSD sample analysis was also conducted on the slag-fill/soil sample from MW-202S (14-16). The analytes recoveries and RPD were within acceptance criteria except for cyanide. The MS/MSD recoveries indicated a matrix effect for a potential low bias. The cyanide result for MW-202S (14-16) was qualified with an M-.

Laboratory Control Sample (LCS)

Laboratory control samples were prepared and analyzed. Acceptance criteria were met. No action was needed to qualify sample data based on LCS recoveries.

Internal Standards performance

Internal standards were within acceptance criteria. No action was needed to qualify sample data based on internal standard performances.

Detection Limit Attainment

Detection limits achieved the QAPP-required objectives. No action was needed to qualify sample data based on detection limits.

Overall Assessment of Data

The data quality was acceptable for the planned use. There are no technical issues other than those identified above. No action was needed to further qualify the sample data.

6.1.1.3 Group B Slag-fill Field QC Results

Completeness

Field completeness is the measure of the amount of valid measurements obtained from all of the measurements taken in the project. Three of four samples were collected during the monitoring well installations. Field completeness is 75%.

Precision

Field precision is measured by the collection of duplicate samples. Due to the non-homogeneity of slag-fill samples and limited sample volume, analysis of duplicate slag-fill samples was not planned nor conducted. The collection and analysis of triple volumes of sample for the measurement of matrix spike/matrix spike duplicate samples provided a better estimate of the range of variability of the solid matrix. MS/MSD sample results are described above.

Accuracy

Accuracy is assessed through the use of field and trip blanks and through the adherence to sample handling, sample preservation and sample holding times. Field blanks (rinsate blanks) were not conducted with the solid samples because reusable equipment was not used to collect slag-fill/soil samples (except for the split spoons and hand augers which did not touch the part of the slag-fill/soil selected for the sample). Deviations from sample handling and preservation did not occur. Management of sample holding times was achieved because the samples were collected by the lab's courier on a daily basis.

6.1.2 Group B Slag-fill Data Useability

All analytical data reported by Microbac is acceptable for use without qualification, other than those qualifiers shown on Table 6-1. Detected analytes reported at concentrations greater than the method detection limit (MDL), but below the reporting limit (RL), were qualified by Microbac and during data validation as estimated with a "J" qualifier, as they are within the region of quantitation associated with less accuracy and precision.

6.2 Group B Slag-fill Data Analysis

The analytical results for the four slag-fill samples collected (from 3 of the 4 well borings) are presented on Table 6-1. Two slag-fill samples were collected from MW201S (14-16 ft and 22-24 ft) and one sample each from MW202S (14-16 ft) and MW204S (14-16 ft). Slag-fill samples were not collected from MW-203S located adjacent to the intake flume. Slag-fill was not obtained during split spoon sampling, nor were cuttings generated during the installation of the monitoring well because the large gravel limestone fill and riprap installed for slope stability and toe buttress. The following is a discussion of the constituents detected.

Very low concentrations of four VOCs were detected in the sample from MW-201S (22-24 ft), collected below the water table. The VOCs included 1,2-dicloroethane (0.004 J mg/L), benzene (0.044 mg/L), ethylbenzene (0.0082 mg/L) and toluene (0.026 mg/L). The only VOC to be detected in the remaining slag-fill samples was toluene. The detected toluene concentration in these three samples was below the reporting limit. Although toluene was not detected in the trip blanks or method blanks, toluene is frequently detected a very low concentrations in lab samples as laboratory artifact.

SVOCs were not detected above MDLs except for bis(2-ethyl-hexyl)phthalate in three of the four slag-fill samples. Bis(2-ethyl-hexyl)phthalate is frequently detected at low concentrations in lab samples as laboratory artifact. PAHs were detected in three of the four slag-fill/soil samples. Metals, cyanide, phenolics and sulfide were also detected in all four slag-fill samples.

6.2.1 Group B Slag-fill DQO and Screening Criteria Evaluation

DQOs and screening criteria were not exceeded for the slag-fill samples in the slag-fill samples collected.

<u>Analytes with MDLs Greater than DQOs</u>

Two analytes were reported as a non-detect concentration with a reported MDL above the DQO in each of the four slag-fill samples. These analytes were bis(2-chloroethyl)ether and n-nitroso-di-n-propylamine. The DQO that was exceeded was the industrial migration to groundwater pathway for each analyte. However, the MDLs for each of these analytes were less than the associated direct contact or construction worker screening criteria. The industrial migration to groundwater DQO established by IDEM in their RISC guidance document acknowledges that analytical methods may not be available to meet the DQO for bis(2-chloroethyl)ether and n-nitroso-di-n-propylamine. The detection limits for these two compounds in the approved QAPP indicated that an MDL lower than the DQO would not be possible. Since these two analytes were not considered to be contaminants of concern for this specific project, the slightly higher MDL was considered acceptable.

Similarly, for groundwater samples a MDL less than the DQO could not be achieved. Neither constituent was detected in the groundwater nor are they considered contaminants of concern likely to be found associated with the operations at Group B.

6.2.2 Group B Slag-fill Receptor Analysis

Group B (Clark Landfill) is located in the north-central portion of the ISG-IH peninsula, and is approximately 39 acres in size. Clark Landfill is wholly contained within a contiguous land that is comprised of manufacturing process areas including buildings, roadways, stock-piled materials or otherwise disturbed ground. The area surrounding the Clark Landfill has no soil (i.e., is composed of slag-fill), vegetation or on-site water source. In addition, due to its active daily use is not believed to be a valuable habitat for birds, insects or mammals. Clark Landfill itself is covered with a cobble size limestone cap (i.e., no soil or vegetation). As a result, without vegetation or a fine-grained soil-type cover, the landfill is also not believed to be a valuable habitat for birds, insects or mammals (etc.). Ecological receptors are not present on the landfill because the limestone cap has no soil or vegetation.

The US EPA Region VI Corrective Action Strategy Ecological Assessment Work Sheets were used for conducting an initial risk screening. A copy of the completed work sheet for Group B is included in Appendix H. The primary receptor identified at Group B is the groundwater. Surface water is not considered a receptor because the landfill is capped and runoff is controlled by a storm water collection system around the perimeter of the landfill.

Groundwater discharge to the Intake Flume is minimized by the isolation of the waste mass from precipitation by the cap and synthetic membrane. This also includes a liner system on the intake flume side of the landfill between the waste mass and the granular fill that was placed for slope protection and buttressing the toe of the landfill. Finally, this groundwater migration pathway will also be managed by IDEM through a post-closure groundwater monitoring program. The analysis of potential migration pathways at the Clark Landfill currently suggests no evidence of a release or imminent threat of a release at the Group B area.

The conceptual site model has been updated based on the analytical results. The updated diagram is included as Figure 1-3. The primary receptor for slag-fill/soil identified at Group B is groundwater. However, a review of the analytical data for the slag fill does not indicate DQO exceedances of the slag-fill/soil to groundwater pathway (Table 6-1). As shown on the conceptual site model diagram (Figure 1-3) for Group B, the pathway for direct contact, ingestion and inhalation are deemed incomplete because the landfill is capped. Terrestrial receptors are not present at Group B because of the absence of habitat (i.e., the area has no slag-fill/soil and little or no vegetation plus heavy vehicular traffic on its perimeter on a continuous basis). The Intake Flume has been listed as a potential receptor because groundwater flow is toward the Flume. Further evaluation of the groundwater pathway is provided in Section 6.4. At Group B, direct discharge of surface water runoff is prevented by the perimeter storm water collection system for the cap and groundwater discharge to the canal is limited by the cap. Therefore, the pathway for slag-fill to impact aquatic receptors within the intake flume is currently deemed incomplete.

6.2.3 Group B Slag-fill Release Analysis

Based on a review of the analytical information for the four subsurface slag-fill samples collected at Group B, the DQOs applicable to the subsurface were not exceeded in the slag-fill samples from the landfill monitoring wells. Therefore, no release has occurred and no further investigation is required for the slag-fill.

6.3 Hydrogeologic Conditions

The upper hydrogeologic unit for the Clark Landfill is the Calumet Aquifer. The Calumet Aquifer is composed of sand and in areas of made-land slag-fill over sand. The bottom of the Calumet sand slopes from south to north toward the lake and, to a lesser extent, from east to west across the Peninsula. The Calumet Aquifer over the Peninsula consists of a thicker sequence of slag-fill over a thin zone of sand because the Peninsula was constructed of slag-fill within Lake Michigan.

Monthly groundwater levels have been conducted at the four monitoring wells installed adjacent to the Clark Landfill since March 2010. Groundwater elevations since March 2010 are shown on Table 6-2 and hydrographs of the water levels over time are depicted on Figure 6-1. As shown in Figure 6-1 groundwater elevations typically vary between approximately 578 ft-msl and 580 ft-msl. Groundwater elevations at well MW-201S, located on the southwest corner of the Landfill, consistently indicated the highest groundwater elevations while groundwater elevations at well MW-203S, located adjacent to the intake flume along the southeastern edge of the Landfill, indicate the lowest groundwater elevations. Surface water elevations within the Intake Flume are generally 1.0 to 1.5 feet lower than monitoring well MW-203S.

The groundwater data for the Clark Landfill indicates that groundwater flow is generally toward the south-southeast, toward the intake flume. Monitoring data collected since February 2010 indicates that these conditions are similar throughout the calendar year. The groundwater flow is influenced locally by the intake flume. Water from the intake flume is continuously pumped to provide water for the mill's various steel-making operations. Groundwater contour maps are provided for selected months as Figures 6-2 through 6-9. Based on these drawings it appears that well MW-201S is an upgradient well and that well MW-202S is also upgradient or slightly side-gradient.

Groundwater gradients were calculated for representative months (April, August and October 2010; January and May 2011) for two well pairs along the flow path. The average horizontal hydraulic gradient at the Clark Landfill ranges from approximately 0.0004 to 0.0009 feet per foot. The average groundwater flow is variable from 266 to 1359 feet/year. The calculated hydraulic gradients and linear flow rate are summarized in Table 6-3.

Hydraulic conductivity tests were conducted at each of the four monitoring wells installed around the Clark Landfill. Hydraulic conductivities were calculated utilizing the Bouwer and Rice (1976) analytical solution for unconfined aquifers. Field data was collected by inducing an instantaneous drawdown in the water level elevation with a disposable high density polyethylene (HDPE) bailer and measuring the water level recovery with a pressure transducer. A total of three individual tests were conducted at each well. Hydraulic conductivity values at each well were determined by calculating the geometric mean of the three tests at that location. A summary of hydraulic conductivity values is presented in Table 6-4.

As shown in Table 6-4 hydraulic conductivities with the slag fill ranged from approximately $1.1\text{x}10^{-2}$ cm/sec to $3.8\text{x}10^{-1}$ cm/sec. Based on the results of the individual well tests the geometric mean of the fill in the vicinity of the wells at the Landfill is approximately $1.2\text{x}10^{-1}$ cm/sec. These results are consistent with those expected for the slag-fill encountered during well installation.

6.4 Groundwater Analytical Results

The laboratory analyses conducted on the groundwater samples included 29 volatile organic compounds (VOCs), 40 semivolatile organic compounds (SVOCs), 16 polynuclear aromatic hydrocarbons (PAHs), 23 metals (dissolved and total) and several general parameters including alkalinity, ammonia, chloride, COD, hardness, total sulfide, TOC, total cyanide and total phenolics. The laboratory analytical results are discussed below. The tabulated analytical results are included on Table 6-5.

Data evaluation conventions used in the discussion of the groundwater results include the following topics:

- Method detection limits and reporting limits;
- Ecological Screening Levels (ESLs) for water;
- Regional arsenic concentrations in groundwater

Method detection limits and reporting limits - When evaluating the groundwater data, the reviewer is cautioned that it is important to remember the basic definitions of the commonly used reporting limits. Results reported below the MDL are regarded as non-detect and results above the MDL are regarded as detections. However, detected results can be further categorized as reported above or below the reporting limit (RL). Values reported between the MDL and the RL are flagged with a "J" value indicating that the concentrations are estimated. Although the analytical laboratory may be able to identify a constituent and report a concentration, the value cannot be properly quantified (i.e., measured within specified limits of precision and accuracy). As a result, the true concentration of data reported below the RL is not accurately known. Since the concentrations are not accurately known, conclusions should not be drawn on whether these criteria are greater than a specified DQO and/or criteria.

In the sections that follow, a comparison of the groundwater results and DQO will be performed as a means of evaluating whether the concentrations detected in the groundwater samples are potentially significant. The groundwater DQOs included the IDEM groundwater solubility, IDEM MCL, industrial groundwater and industrial default closure, which were derived from the IDEM RISC Technical Guide.

ESLs for water - The work plan also included a US EPA ESL for water. The ESL's for water are primarily for comparison against surface water quality data but can potentially apply to groundwater that is directly accessible to wildlife. For this investigation, surface water samples were not collected and a review of the Clark Landfill did not identify surface features where groundwater would be accessible to wildlife. Furthermore, offsite groundwater-surface water interactions were not within the scope of this investigation and AECOM does not believe that the direct comparison of surface water criteria to groundwater is applicable without considering/including groundwater surface water interactions. In the case of groundwater discharges to surface water, significant mixing and dilution occur at the interface. The amount of mixing can be significant (100X, 1000X, etc.) and must be considered prior to comparison. Therefore, based on review of the physiography of the Group (i.e., absence of direct access to groundwater), the DQOs to which the groundwater have been compared are the IDEM groundwater solubility, IDEM MCL, industrial groundwater and industrial default closure listed in the RISC Technical Guide.

Arsenic - Arsenic is a naturally-occurring element in the earth's crust. Detectable concentrations of arsenic in groundwater and in slag-fill/soil are common across the Midwest. Recent studies in Illinois and Indiana have shown that significant numbers of residential/community groundwater wells exceed the US EPA Safe Drinking Water Act Maximum Contaminant Level (MCL) for arsenic of 0.010 mg/L for public and community water supplies. An Indiana State Department of Health study of groundwater in Fulton County (several counties south of the ArcelorMittal Indiana Harbor study area) observed that residential water supply well concentrations of arsenic ranged between 0.005 and 0.048 mg/L. These concentrations are attributable to naturally-occurring sources. A study of the groundwater in northwest Indiana by the USGS (June 1993 Rpt #95-4244) detected dissolved arsenic concentrations in 69 of 128 wells (monitoring, residential, production, etc.), 48 of which were in the Calumet Aquifer. The samples from these wells were analyzed by the USGS and ranged in concentration from 0.0017 to 0.292 mg/L. Therefore, the presence of detectable concentrations of naturally occurring arsenic in slag-fill/soil and groundwater is not uncommon. A further discussion of arsenic detections is provided in Section 6.5.1.

6.4.1 Group B Groundwater Data Validation Results

The laboratory analytical results for the Clark Landfill groundwater samples were provided in one laboratory sample delivery group. The lab data was validated and found to be 100% complete. The analytical results have been tabulated, validated and qualified and provided in Table 6-5. The data validation is described in the next subsections. A copy of the laboratory analytical report and the Level IV QC data package is contained on a CD in Appendix I. All data was acceptable and is considered usable.

A groundwater sample was collected from each of the four water table monitoring wells. The groundwater samples and three quality control samples were analyzed by Microbac for the analytes and methods shown on below. The methods used by the laboratory were those approved in the project Quality Assurance Project Plan.

Analysis	Method
Alkalinity	SM2320B Rev 18
Chloride	APHA 4500CL-B Rev 18
Chemical Oxygen Demand	EPA 410.4 Rev 2.0
Dissolved Mercury	SW7470A
Dissolved Metals by ICP/MS	SW6020A
Hexavalent Chromium	SM 3500-CR-D Rev 18
Hardness	SM2340B Rev 18
Nitrogen, Ammonia as N	EPA 350.1 Rev 2.0
PAHs by GC/MS SIM	SW8270C
SVOCs w/Low Level PAHs	SW8270C
Sulfate	SW9038
Total Cyanide	SW9012B
Total Mercury	SW7470A
Total Metals by ICP/MS	SW6020A
Total Organic Content	SM 5310C
Total Phenolics	SW9066
Total Sulfide	SM 4500-S2-D
Volatile Organic Compounds	SW8260B

6.4.1.1 Group B Groundwater Completeness Assessment

The Microbac data package received was complete. All samples that were submitted and indicated for analysis were analyzed. The data package for Microbac Work Order10F0474 is included in the review of the Group B wells results.

6.4.1.2 Compliance Assessment-Group B Groundwater

<u>Holding Times/Preservation</u>

Submitted samples were received on ice in sample containers preserved as appropriate. Samples were extracted and analyzed within the method-required holding times. No action was needed to qualify sample data based on holding time.

Initial Calibration Verification (ICV)/Continuing Calibration Verification (CCV)

Initial and continuing calibration and calibration verification were conducted in general conformance with method requirements. The calibration and continuing calibration data met the required control or recovery limits. No action was needed to qualify sample data based on calibration data.

Laboratory Blanks

Laboratory blanks were prepared and extracted with the method-required frequency per laboratory batch of 20 samples or less. Analytes detected in the method blanks are shown below. The *National Functional Guideline for Inorganic Data Review* indicate that the action for reporting the sample results when the method blank is less than the reporting limit but more than the method detection limits should be to report results as detected below the reporting limit (i.e. as a non-detect). However, because reporting to the MDL was required as part of QAPP and work plan approvals, a "B" qualifier was used to denote those samples/analytes which had been detected in the laboratory blank and the sample concentration was less than or equal to 5X the blank. These qualified samples are considered estimated concentrations and may not be a true indicator of a DQO exceedance because the laboratory artifact caused or inflated the detected value.

Analyte Detected in Blank	Concentration Detected in Blank in mg/L
Total and dissolved Chromium	0.0019
Total and dissolved Molybdenum	0.00093
Total and dissolved Zinc	0.0046
Acenaphthene	0.000010
Naphthalene	0.000040
Phenanthrene	0.000020

1,2-Dichlorobenzene was also detected in the method blank, but was not detected in the groundwater samples. A qualifier was therefore, not used.

Surrogate Recoveries

Surrogate recoveries were within acceptance criteria for percent recovery. The data reviewed was of acceptable quality. No action was needed to qualify the data based on surrogate recoveries.

Matrix Spike/Matrix Spike Duplicate Samples

A laboratory matrix spike/matrix spike duplicate (MS/MSD) percent recovery (recovery) and relative percent difference (RPD) were within acceptance criteria. No action was needed to qualify the data based on the MS/MSD results.

Laboratory Control Sample (LCS)

Laboratory control samples were prepared and analyzed as specified by the individual methods. Acceptance criteria were met. No action was needed to qualify sample data based on LCS recoveries.

Internal Standards performance

Internal standards were within acceptance criteria unless a dilution was required. No action was needed to qualify sample data based on internal standard performances.

Detection Limit Attainment

Detection limits achieved or exceeded the QAPP-required objectives except when a dilution was required to quantify a detected analyte. Detection limits for analytes not detected are shown on Table 6.5. No action was needed to qualify sample data based on detection limits.

Overall Assessment of Data

The data quality was acceptable for the planned use. There are no other technical issues other than those identified above. No action was needed to further qualify the sample data.

6.4.1.3 Group B Groundwater Field QC Results

Field Completeness

The field completeness achieved 100% as four samples were planned and four samples were collected. No modifications to the sample collection procedures were required that impacted data quality.

Field Precision

Precision was evaluated by the collection and analysis of duplicate samples. A duplicate sample was collected from MW-203S. The objective for field precision was 30% RPD when both the sample result and its duplicate are greater than five times their reporting limit. If both results are less than five times the reporting limit then satisfactory precision occurs if the results agree within 2.5 times the reporting limit.

Values reported between the MDL and the RL are flagged with a "J" value indicating that the concentrations are estimated. Although the analytical laboratory may be able to identify a constituent and report a concentration, the value cannot be properly quantified (i.e., measured within specified limits of precision and accuracy). As a result, the true concentration of data reported below the RL is not known. Field precision criteria were met for the Group B for samples detected above the RL except for the following analytes detected above the reporting limit: naphthalene, chemical oxygen demand and total cyanide.

Field Bias

Field bias is evaluated by the collection of field blank (rinsate blank) samples. New disposable tubing was used for each groundwater sample. A rinsate blank was collected after the groundwater sample from MW-204S. Five PAHs were detected in the rinsate blank, but at concentrations near the method detection limit. Two of the five detected PAHs were also detected in the method blank. Seven total metals were detected in the rinsate blank and all were values detected below the reporting limit. Two of the seven metals detected were also detected in the laboratory method blank. Similarly, 10 dissolved metals were detected in the rinsate blank and all values were detected below the reporting limit. Additionally, three metals were detected in the laboratory method blank. Ammonia was detected in the rinsate blank slightly above the reporting limit.

6.4.2 Group B Groundwater Data Usability

Analytical data reported by Microbac is acceptable for use without qualification, other than those qualifiers shown on Table 6.5. Detected analytes reported at concentrations greater than the method detection limit (MDL), but below the reporting limit (RL), were qualified by Microbac and during data validation as estimated with a "J" qualifier, as they are within the region of quantitation associated with less precision.

6.5 Group B Groundwater Data Analysis

A tabulation of the stabilized field parameters for each well taken prior to sample collection are presented in Table 6-6. Review of the stabilized field parameters indicates that turbidity of the samples ranged from 2 to 12 ntu. The groundwater temperature ranged from 18°C to 21°C. The field pH of the shallow wells ranged from 9.21 standard units (SU) to 11.83 SU. The specific conductance values of the shallow wells ranged from 0.36 to 2.23 mS/cm. Finally, the oxidation-reduction potential (ORP) values ranged from -113 to -336 mv. The negative ORP values of the water table wells generally indicate reducing conditions.

Review of the laboratory analytical data indicates a very limited number of VOCs were detected in the groundwater samples (refer to Table 6-5). Five VOCs (benzene, chloroform, 1,1-dichloroethane, ethylbenzene and toluene) of the 29 constituents tested were detected at concentrations above method detection limits (MDLs). With the exception of benzene and toluene at well MW-203S, all of the results were estimated values (flagged "J") because they were at concentrations less than the RL.

SVOCs were not detected in the four groundwater samples or the sample duplicate.

Nine of 16 PAHs were detected above the MDLs in the groundwater samples. Only three of the PAHs (fluoranthene, naphthalene, and phenanthrene) were detected above the reporting limit and only in the groundwater samples from two wells (MW-203S and MSW-204S). The remaining PAHs were estimated values (flagged "J") and three PAHs in the groundwater sample from MW-202S were likely attributable to blank contamination in the laboratory.

Approximately 15 of the 21 total metals analyzed were detected in the groundwater samples from the Clark Landfill monitoring wells. The total metal parameters not detected include beryllium, cadmium, mercury, nickel, and silver. Review of total metal results for the trace metals (excluding major cations such as calcium iron, magnesium, manganese and sodium) indicates that boron, chromium, hexavalent chromium, molybdenum, selenium, thallium and zinc had one or more concentrations reported above the reporting limits. The total boron levels ranged from 0.13 to 0.28 mg/L, while total molybdenum concentrations ranged from 0.027 to 0.030 mg/L. Chromium, hexavalent chromium, selenium, thallium and zinc each had one groundwater sample concentration detected above the reporting limit. The remaining metals were reported as estimated values (i.e., between the RL and MDL) and were flagged with a "J" qualifier. Comparison of the dissolved and total metals concentrations indicates that the detected metal species are similar, but the concentrations detected in the dissolved samples were generally lower. Two metals, chromium and zinc, (both total and dissolved) were detected in the laboratory method blanks. The reported results were qualified to reflect this potential laboratory inflation of the true detected concentration.

General parameters were detected in a majority of the groundwater samples with the exception of total cyanide and total phenolics, which were non-detect in the groundwater samples from three of the four wells, but detected in the sample from MW-203S. The detection of these parameters is generally expected since many are major ions or constituents commonly found in groundwater. Summarizing several of the parameters, the concentrations ranged from 0.27 to 2.5 mg/L for ammonia, 34 to 210 mg/L for chloride, 8.4 to 27 mg/L for Chemical Oxygen Demand (COD) and non-detect to 10 mg/L for sulfide.

6.5.1 Group B Groundwater DQO Evaluation

Table 6-7 presents a summary of an analyte by analyte comparison of the Group B samples to the IDEM Industrial DQOs and screening criteria (DQO/criteria). The upper portion of the table presents the analytical data for samples above their respective DQO/criteria sorted by analyte, while the lower portion presents the same information sorted by location. The left-hand portion of the table presents the results for each constituent, while the right-hand portion of the table indicates the concentration of the industrial DQO/criteria that has been exceeded.

<u>Benzene</u> - The only VOC constituent above DQOs in the groundwater samples was benzene at well MW-203S. The benzene concentration was 0.051 mg/L in the primary sample and 0.055 mg/L in its duplicate, which exceeded the IDEM MCL (0.005 mg/L) and the duplicate slightly exceeded the industrial groundwater criteria/default closure level (0.052 mg/L).

For metals, total metal concentrations were compared against the DQOs. This approach is a conservative approach because the total metals concentration should be equal or greater than the dissolved metal concentration. However, this assumption may not be accurate where suspended solids are present (as indicated by turbidity measurements) and may contribute significantly to the concentration of unfiltered samples.

As indicated in Section 6.0, the DQOs used for evaluation are the IDEM groundwater solubility, MCL, IDEM industrial groundwater and IDEM industrial default closure limits. Groundwater concentrations above the DQOs are shown on Figure 6-1 for the water table wells sampled in June 2010. Comparison of the groundwater data to the DQOs indicate that only two constituents were reported with concentrations above the DQOs. These two constituents include total arsenic at monitoring wells MW-201S (0.0034 J mg/L) and MW-202S (0.0025 J mg/L), which is above the IDEM industrial groundwater DQO, and total thallium at well MW-201S (0.0034 mg/L) which is above the IDEM MCL DQO. It should be noted that based on the groundwater contour drawings monitoring wells, MW-201S and MW-202S are upgradient of Clark Landfill.

Note that all of the arsenic values that were above DQOs were qualified ("J") as estimated values. In other words, the concentration of these constituents was not sufficient to quantify the results within the specified limits of precision and accuracy. Estimated values (values below the reporting limits) above DQOs should not be given the same significance as would a value reported above the reporting limit.

<u>Arsenic</u> - Arsenic is a naturally-occurring element in the earth's crust. Detectable concentrations of arsenic in groundwater and in slag-fill/soil are common across the Midwest. Recent studies in Illinois and Indiana have shown that significant numbers of residential/community groundwater wells exceed the US EPA Safe Drinking Water Act Maximum Contaminant Level (MCL) for arsenic of 0.010 mg/L for public and community water supplies. An Indiana State Department of Health study of groundwater in Fulton County (several counties south of the ISG-IH/Tecumseh study area) observed that residential water supply well concentrations of arsenic ranged between 0.005 and 0.048 mg/L.

These concentrations are attributable to naturally-occurring sources. A study of the groundwater in northwest Indiana by the USGS (June 1993 Rpt #95-4244) detected dissolved arsenic concentrations in 69 wells (monitoring, residential, production, etc.), 48 of which were in the Calumet Aquifer. The samples from these wells were analyzed by the USGS and ranged in concentration from 0.0017 to 0.292 mg/L.

As indicated above, the total arsenic levels at wells MW-201S (0.0034 J mg/L) and MW-202S (0.0025 J mg/L) were slightly above the IDEM industrial groundwater value. What is unusual about the IDEM RISC criteria is that the industrial groundwater value (0.0019 mg/L) is significantly less than the current US EPA drinking water MCL (0.010 mg/L). The concentrations in both wells are below the current US EPA and IDEM drinking water MCL as well as the IDEM default closure values. Furthermore, examination of the filtered results indicates that the dissolved arsenic concentrations were 0.0018 and 0.0017 mg/L, respectively and these concentrations are less than the IDEM industrial DQO. Therefore, the total arsenic concentrations may reflect a contribution from suspended material, which is not representative of true concentration that is transported in the groundwater.

Thallium - The total thallium concentration detected at MW-201S (0.0034 mg/L) exceeds the IDEM MCL of 0.002 mg/L. A review of the filtered results for this sample indicates a reported concentration of 0.00059J mg/L which is well below the IDEM MCL for thallium. Therefore, the reported concentration for the total analysis is likely attributable to suspended/colloidal material in the groundwater samples, but the concentrations are not of high concentration to warrant additional investigation because the other IDEM DQOs were not exceeded and the area is not a source of drinking water.

6.5.2 Group B Groundwater Receptor Analysis

The US EPA Region VI Corrective Action Strategy Ecological Assessment Work Sheets were used for conducting an initial risk screening. A copy of the completed work sheet for Group B is included in Appendix G. The primary receptor identified at Group B is the groundwater. Surface water is not considered a receptor because the landfill is capped and runoff is controlled by a storm water collection system around the perimeter of the landfill. However, groundwater discharge to the Intake Flume is limited by the isolation of the waste mass from precipitation by the cap.

Clark Landfill is wholly contained within contiguous land that is comprised of manufacturing process areas including buildings, roadways, stock-piled materials or otherwise disturbed ground. Ecological receptors are not present at the landfill because the Landfill's limestone cap has no soil or vegetation. Because of its cap, it is not believed to be a valuable habitat for birds, insects or mammals (etc.). In addition the area surrounding the landfill is slag-fill with no soil, vegetation or on-site water source, and due to its active daily use, is also not believed to be a valuable habitat for birds, insects or mammals.

The ingestion and direct contact pathways for groundwater are incomplete because the landfill is capped and exposure to groundwater will not occur. The potential migration pathway is managed by post-closure groundwater monitoring. As such, the analysis of potential migration pathways at the Clark Landfill currently suggests that there is no evidence of a release or imminent threat of a release at the Group B area.

6.5.3 Group B Groundwater Release Analysis

Based on a review of the analytical information for the four groundwater wells installed at Group B, only three constituents were detected above DQOs (benzene, arsenic and thallium).

Benzene was detected in one groundwater sample above the IDEM MCL and slightly above the IDEM industrial default closure value in the sample duplicate. The well from which the sample was collected, MW-203S is immediately adjacent to the intake flume, but is also located in the downgradient direction of groundwater flow from the landfill. Because the well was completed within the rip-rap placed to protect the landfill from further slope failures, the water in the well is in close communication with the water in the intake flume. Therefore, with a single sample event and evaluation of the significance of the DQO exceedances cannot be determined. Groundwater at the Clark landfill will be subject to post-closure monitoring and additional data will be collected for a further evaluation of the benzene detection. This evaluation will include statistical comparison of upgradient and downgradient water quality. This statistical comparison is likely to be a better than a comparison to DQOs as a means of judging whether the landfill is influencing groundwater quality.

Total arsenic was detected in two of four samples tested above the industrial groundwater DQO. Arsenic was not detected above the IDEM MCL or default closure DQO. Review of the filtered results indicates that the dissolved arsenic concentrations were 0.0018 and 0.0017 mg/L, respectively and these concentrations are less than the IDEM industrial DQO. Based on the results of the groundwater sampling data, the total arsenic concentrations in groundwater are well within the range of naturally occurring arsenic concentrations. Further, the dissolved arsenic groundwater concentrations are below the DQOs. Finally, based on the groundwater contour maps it appears that these two wells with are likely upgradient of the landfill. Therefore, these arsenic concentrations observed would not be attributable to the landfill.

Similarly, one thallium concentration was above the IDEM MCL in the total sample, but well below this DQO in the filtered sample. This thallium detection occurred at well MW-201S, which based on the groundwater contour maps is an upgradient well. Therefore, the concentration observed would not be attributable to the landfill.

In summary, one concentration of benzene was slightly above the DQO (IDEM Default Closure) in a duplicate sample but below the DQO in the primary sample. Additional sampling as part of the post-closure groundwater monitoring will be performed to determine if this concentration persists. The groundwater sampling has indicated the presence of low concentrations of arsenic (i.e., estimated concentrations below the reporting limit) in two upgradient wells and neither concentration was above the IDEM Default Closure value. Finally, thallium was detected slightly above the IDEM MCL at an upgradient well, but again did not exceed the IDEM Default Closure value. Therefore, no further investigation is required beyond the post-closure groundwater monitoring that will be conducted in conformance with IDEM-approved post-closure care of the landfill.

7.0 Summary and Conclusions

Four groundwater monitoring wells were installed around the perimeter of the Clark Landfill to assess the landfill. Four subsurface slag-fill/soil samples and four groundwater samples were collected and analyzed for 29 volatile organic compounds (VOCs), 40 semivolatile organic compounds (SVOCs), 16 polynuclear aromatic hydrocarbons (PAHs), 23 metals (dissolved and total) and several general parameters including alkalinity, ammonia, chloride, COD, hardness, total sulfide, TOC, total cyanide and total phenolics.

The Clark Landfill is located within an industrial complex with on-going active industrial operations. The landfill and surround area does not have significant ecological habitats. This landfill itself was capped with a cobble size limestone (i.e., no soil or vegetation). The surrounding area is also not attractive to wildlife because of the lack of soil, vegetation and the active industrial operations. As such, it is inappropriate to compare the slag-fill/soil and groundwater data from the landfill monitoring wells to ecological criteria or ESLs.

DQOs and screening criteria applicable to the subsurface were not exceeded in the slag-fill samples analyzed from the monitoring wells installed at Clark Landfill. Based on the results, it is concluded that no releases from the landfill have occurred.

The DQOs utilized for evaluation of the groundwater analytical data included the IDEM groundwater solubility, IDEM MCL, industrial groundwater and industrial default closure, which were derived from the IDEM RISC Technical Guide.

Benzene was detected in one groundwater sample above the IDEM MCL and slightly above the IDEM industrial default closure value in the sample duplicate. The well from which the sample was collected, MW-203S is adjacent to the intake flume and in the down-gradient direction of groundwater flow from the landfill. It is located within the rip-rap placed to protect the landfill from further slope failures. This result represents a single sample event and evaluation of the significance of the DQO exceedance should not be determined based on a single result and without a comparison to upgradient water quality. Groundwater at the Clark Landfill will be subject to post-closure monitoring and additional data will be collected to further evaluate this single benzene detection.

Total arsenic was detected in two of four samples tested above the industrial groundwater DQO. These detections occurred in samples collected from wells that appear to be hydraulically upgradient of the landfill. Arsenic was not detected above the IDEM MCL or default closure DQO. Review of the filtered results indicates that the dissolved arsenic concentrations were 0.0018 and 0.0017 mg/L, respectively and these concentrations are less than the IDEM industrial DQO. Based on the results, the total arsenic concentrations in groundwater are within the range of naturally occurring arsenic concentrations. Therefore, the arsenic concentrations do not indicate that an adverse impact of groundwater related to the landfill has occurred.

Similarly, one thallium concentration was above the IDEM MCL in the total sample, but well below this DQO in the filtered sample. This detection also occurred at a well hydraulically upgradient of the landfill. Therefore, the thallium concentration does not indicate that an adverse impact of groundwater attributable to the landfill.

In summary, the IDEM general water quality parameters were detected in a majority of the groundwater samples. The detection of these parameters is expected since many are major ions or constituents commonly found in groundwater. For the organic constituents, only a very limited number of VOCs were detected in the groundwater samples. No SVOCs were detected and only three PAHs were detected above the reporting limits, but none were above the DQOs and screening criteria. Benzene was the only organic constituent detected slightly above a DQO and this detection will be addressed with post-closure groundwater monitoring. For metals, results above DQOs included the presence of low concentrations of arsenic (below the reporting limit) in two upgradient wells and a low concentration of thallium at an upgradient monitoring well. However, these metal detections are not attributable to Clark Landfill since there were observed at hydraulically upgradient wells. Consequently, comparison of these initial groundwater results with the DQOs and screening criteria did not substantiate groundwater quality impacts that would be indicative of a release from the landfill.

8.0 References

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Tables

Table 5-1
Visual and Olfactory Observations during Soil Boring Advancement
ArcelorMittal Indiana Harbor, Clark Landfill

Boring/Well Number	Depth (bgs in feet)	PID Reading	Visual Observation [1]	Olfactory Observation [2]	Comments
MW-201S	0-2				Blind drilled-surface slag-fill
	2-4	0	--	--	
	4-6	0	--	--	
	6-8	0	--	--	
	8-10	0	--	--	
	10-12	0	--	--	
	12-14	0	--	--	
	14-16	0	--	--	
	16-18	0	--	--	
	18-20	0	--	--	
	20-22	0	Sl. Sheen @ 21'	faint odor @ 21'	
	22-24		--	--	
	24-28		--	--	Blind Drilled
MW-202S	0-2				Blind drilled-surface slag-fill
	2-4		--	--	
	4-6		--	--	
	6-8		--	--	
	8-10		--	--	
	10-12		--	--	
	12-14		--	--	
	14-16		--	--	
	16-18		--	--	
	18-20		--	--	
	20-22		--	--	
	22-24		--	--	
	24-30		--	--	Blind Drilled
MW-203S	0-12				Blind Drilled, through armor stone placed to surchage the toe of the failure zone and to protect the intake flume side of the landfill .
	12-14		--	--	too little recovery for samling or PID
	14-16		--	--	as above
	16-18		--	--	as above
MW-204S	0-2				Blind Drill
	2-4	0	--	--	
	4-6	0	--	--	
	6-8	0	--	--	
	8-10	0	--	--	
	10-12	0	--	--	
	12-14	0	--	--	
	14-16		--	--	
	16-18		--	--	
	18-20		--	--	
	20-22		--	--	
	22-24		--	--	
	24-28		--	--	

Notes:
[1] Visual observation does not include, color, moisture content, cohesiveness or other physical description normally provided on a soil boring log.
[2] Subjective description provided by geologist during borehole logging. Not reproduceable or correlatable to PID readings or laboratory analytical results.
-- = No visual or olfactory observation reported on boring log or field notes.

Table 6-1
Group B - Clark Landfill Slag-fill/Soil Laboratory Analytical Results

	Other Screening Criteria		DQOs						
	IDEM[1]	IDEM[1]	IDEM[1]	IDEM[1]	EPA[2]				
Client ID	Construction Worker	Direct Contact	Migration to GW	Default Closure Level	ESLs - Soil	MW201S-S-(14-16)	MW201S-S-(22-24)	MW202S-S-(14-16)	MW204S-S-(14-16)
VOCs in mg/kg									
1,1,1-Trichloroethane	34,000	6,700	280	280	29.8	<0.0021	<0.0016	<0.0014	<0.0053
1,1,2,2-Tetrachloroethane	960	8.7	0.11	0.11	0.127	<0 003	<0.0022	<0.0019	<0.0075
1,1-Dichloroethane	8,600	1,700	58	58	20.1	<0.0015	0.004 J	<0.00097	<0.0037
1,1-Dichloroethene	2,200	410	42	42	8.28	<0.0025	<0.0019	<0.0017	<0 0064
1,2-Dichloroethane	150	5.8	0.15	0.15	21.2	<0.0025	<0.0019	<0.0017	<0.0064
1,2-Dichloropropane	99	7.2	0.25	0.25	32.7	<0.0021	<0.0016	<0.0014	<0.0053
1,3-Dichloropropane	NE	NE	NE	NE	NE	<0.0015	<0.0011	<0.00097	<0.0037
2-Chloroethyl vinyl ether	NE	NE	NE	NE	NE	<0.0049	<0.0036	<0.0032	<0.012
Acrolein	3.5	0.64	0.25	0.25	5.27	<0.033	<0.025	<0.022	<0.084
Acrylonitrile	NE	NE	NE	NE	0.0239	<0.028	<0.02	<0.018	<0.069
Benzene	560	14	0.35	0.35	0.255	<0.0025	0.044	<0.0017	<0.0064
bis (Chloromethyl) ether	NE	NE	NE	NE	NE	<0.011	<0.0078	<0 0069	<0.027
Bromoform	7,700	580	2.7	2.7	15.9	<0.0015	<0.0011	<0.00097	<0.0037
Bromomethane	69	13	0.7	0.7	0.235	<0.0076	<0.0056	<0.005	<0.019
Carbon tetrachloride	38	5.2	0.29	0.29	2.98	<0.0025	<0.0019	<0.0017	<0.0064
Chlorobenzene	2,600	510	27	27	13.1	<0.0013	<0.00094	<0.00083	<0.0032
Chlorodibromomethane	NE	NE	NE	NE	2.05	<0 0017	<0.0013	<0.0011	<0.0043
Chloroethane	16,000	120	10	10	NE	<0.0051	<0.0038	<0.0033	<0.013
Chloroform	650	4.7	6	4.7	1.19	<0 0013	<0.00094	<0.00083	<0.0032
Chloromethane	NE	NE	NE	NE	10.4	<0 0032	<0.0024	<0.0021	<0.008
Dichlorobromomethane	2,100	17	0.51	0.51	0.54	<0.0011	<0.00078	<0.00069	<0.0027
Dichlorodifluoromethane	NE	NE	NE	NE	39.5	<0.0097	<0.0072	<0.0064	<0.025
Ethylbenzene	29,000	6,800	200	160	5.16	<0 0015	0.0082	<0.00097	<0.0037
Methylene chloride	22,000	200	1.8	1.8	4.05	<0.018	<0.014	<0.012	<0.046
Tetrachloroethene	660	16	0.64	0.64	9.92	<0 0034	<0.0025	<0.0022	<0.0085
Toluene	49,000	16,000	96	96	5.45	0.0016 J	0.026	0.001 J	0.0061 J
trans-1,2-Dichloroethene	1,200	230	14	14	0.784	<0.0021	<0.0016	<0.0014	<0.0053
Trichlorofluoromethane	6,900	1,300	540	540	NE	<0.0072	<0.0053	<0.0047	<0.018
Vinyl chloride	500	6.4	0.027	0.027	0.646	<0.0036	<0.0027	<0.0024	<0.0091
PAHs in mg/kg									
Acenaphthene	50,000	24,000	1,800	1,800	682	<0.0067	0.26	<0.0064	<0.0068
Acenaphthylene	5,900	2,800	180	180	682	<0.0064	0.4	<0.0062	<0.0066
Anthracene	250,000	120,000	36,000	2,000	1,480	<0.0093	0.78	<0.0089	<0.0095
Benzo-a-anthracene	790	15	62	15	5.21	0.049 J	0.55	<0.0076	0.13
Benzo(a)pyrene	79	1.5	16	1.5	1.52	0.052 J	<0.026	<0.0081	0.11
Benzo(b)fluoranthene	790	15	190	15	59.8	<0.013	0.44	<0.013	0.13
Benzo(g,h,i)perylene	NE	NE	NE	NE	119	0.041 J	<0.026	<0.0081	0.06 J
Benzo(k)fluoranthene	7,900	150	1,900	150	148	<0.011	<0.034	<0.011	<0.011
Chrysene	79,000	1,500	6,200	1,500	4.75	0.075	0.9	<0.0071	0.12
Dibenz(a,h)anthracene	79	1.5	60	1.5	18.4	<0.0088	<0.027	<0.0084	<0.009
Fluoranthene	33,000	16,000	18,000	2,000	122	0.13	1.9	<0.011	0.38
Fluorene	33,000	16,000	2,300	2,000	122	<0.0069	1	<0.0066	<0.0071
Indeno(1,2,3cd)pyrene	790	15	540	15	109	<0.0081	<0.025	<0.0078	0.056 J
Naphthalene	17,000	8,000	170	170	0.0994	<0.0063	1.5	<0.006	<0.0065
Phenanthrene	2,500	1,200	170	170	45.7	0.044 J	2.8	<0.0095	0.16
Pyrene	25,000	12,000	13,000	2,000	78.5	0.088	1.6	<0.007	0.23

Table 6-1
Group B - Clark Landfill Slag-fill/Soil Laboratory Analytical Results

	Other Screening Criteria		DQOs						
	IDEM[1]	IDEM[1]	IDEM[1]	IDEM[1]	EPA[2]				
Client ID	Construction Worker	Direct Contact	Migration to GW	Default Closure Level	ESLs - Soil	MW201S-S-(14-16)	MW201S-S-(22-24)	MW202S-S-(14-16)	MW204S-S-(14-16)
SVOCs in mg/kg									
1,2,4-Trichlorobenzene	8,900	4,900	77	77	11.1	<0.027	<0.085	<0.026	<0.028
1,2-Dichlorobenzene	18,000	3,900	270	220	2.96	<0.023	<0.072	<0.022	<0.024
1,2-Diphenylhydrazine	NE	NE	NE	NE	NE	<0.025	<0.077	<0.024	<0.025
1,4-Dichlorobenzene	8,000	73	3.4	3.4	0.546	<0.025	<0.077	<0.024	<0.025
2,4,6-Trichlorophenol	89*	49*	0.2	0.2	9.94	<0.02	<0.061	<0.019	<0.02
2,4-Dichlorophenol	2700*	1500*	3	3	87.5	<0.044	<0.14	<0.042	<0.045
2,4-Dimethylphenol	18,000*	9,800*	25	25	0.01	<0.035	<0.11	<0.033	<0.035
2,4-Dinitrophenol	1,800	980	0.82	0.82	0.0609	<0.035	<0.11	<0.034	<0.036
2,4-Dinitrotoluene	890	20	NE	NE	1.28	<0.37	<1.1	<0.35	<0.38
2,6-Dinitrotoluene	890	20	NE	NE	0.0328	<0.044	<0.14	<0.042	<0.045
2-Chloronaphthalene	71,000	39,000	560	560	0.0122	<0.043	<0.14	<0.042	<0.045
2-Chlorophenol	2200*	580*	10	10	0.243	<0.072	<0.22	<0.069	<0.074
2-Nitrophenol	NE	NE	NE	NE	1.6	<0.028	<0.087	<0.027	<0.029
3,3'-Dichlorobenzidine	1,400	31	0.21	0.21	0.646	<0.038	<0.12	<0.036	<0.038
4,6-Dinitro-2-methylphenol	NE	NE	NE	NE	0.144	<0.052	<0.16	<0.049	<0.053
4-Bromo-phenyl phenyl ether	NE	NE	NE	NE		<0.051	<0.16	<0.049	<0.053
4-Chloro-3-methylphenol	NE	NE	NE	NE	NE	<0.027	<0.085	<0.026	<0.028
4-Chlorophenyl phenyl ether	NE	NE	NE	NE	NE	<0.059	<0.18	<0.056	<0.06
4-Nitrophenol	NE	NE	NE	NE	5.12	<0.025	<0.079	<0.024	<0.026
Benzidine	NE	NE	NE	NE	NE	<0.35	<1.1	<0.33	<0.36
Bis(2-chloro-ethoxy)methane	NE	NE	NE	NE	0.302	<1.7	<5.3	<1.6	<1.7
Bis(2-chloro-ethyl)ether	280	3	0.012	0.012	23.7	<0.026	<0.081	<0.025	<0.027
Bis(2-chloro-isopropyl)ether	NE	NE	NE	NE	19.9	<0.025	<0.077	<0.024	<0.025
Bis(2-ethyl-hexyl)phthalate	18,000	980	120,000	980	0.925	0.21 J	<0.18	0.15 J	0.11 J
Butyl benzyl phthalate	180,000	98,000	6,200	310	0.239	<0.047	<0.15	<0.045	<0.049
Diethyl phthalate	710,000	390,000	1,300	840	24.8	<0.041	<0.13	<0.039	<0.041
Dimethyl phthalate	1,000,000	1,000,000	5,600	1,100	734	<0.029	<0.091	<0.028	<0.03
Di-n-butyl phthalate	89,000	49,000	NE	NE	0.150	<0.043	<0.13	<0.041	<0.044
Di-n-octyl phthalate	36,000	20,000	67,000	2,000	709	<0.068	<0.21	<0.065	<0.069
Hexachlorobenzene	390	8.6	3.9	3.9	0.199	<0.038	<0.12	<0.036	<0.038
Hexachlorobutadiene	NE	NE	NE	NE	0.0398	<0.024	<0.075	<0.023	<0.025
Hexachlorocyclopentadiene	5,300	2,900	4,900	720	0.755	<0.03	<0.093	<0.029	<0.031
Hexachloroethane	660	240	7.7	7.7	0.596	<0.028	<0.087	<0.027	<0.029
Isophorone	180,000	14,000	18	18	139	<0.023	<0.071	<0.022	<0.024
Nitrobenzene	440	250	0.34	0.34	1.31	<0.023	<0.071	<0.022	<0.024
N-Nitrosodimethylamine	NE	NE	NE	NE	0.0000321	<0.089	<0.28	<0.085	<0.091
N-Nitroso-di-n-propylamine	89	2	0.002	0.002	0.544	<0.028	<0.087	<0.027	<0.029
N-Nitrosodiphenylamine	180,000*	2,800*	32	32	0.545	<0.026	<0.081	<0.025	<0.027
Pentachlorophenol	3,800	54	0.66	0.66	0.119	<0.052	<0.16	<0.05	<0.054
Phenol	230,000*	96,000*	160	160	120	<0.028	<0.086	<0.026	<0.028

Table 6-1
Group B - Clark Landfill Slag-fill/Soil Laboratory Analytical Results

	Other Screening Criteria		DQOs						
	IDEM[1]	IDEM[1]	IDEM[1]	IDEM[1]	EPA[2]				
Client ID	Construction Worker	Direct Contact	Migration to GW	Default Closure Level	ESLs - Soil	MW201S-S-(14-16)	MW201S-S-(22-24)	MW202S-S-(14-16)	MW204S-S-(14-16)
Metals in mg/kg									
Antimony	460*	620*	37	37	$78^{SI}/0.29^{M}$	<0.0024	0.91	0.018^{J}	0.13^{J}
Arsenic	320*	20*	5.8	5.8	5.7	<0.049	2.1^{J}	<0.048	1.1^{J}
Beryllium	2,300	2,900	3,200	2,300	$40^{SI}/36^{M}$	9.2	6.6	8.1	6.9
Cadmium	590*	990*	77	77	$32^{P}/140^{SI}/1.0^{AV}/0.38^{M}$	6.2	2.1	0.99	1.7
Chromium	1,000,000*	1,000,000*	1,000,000	10,000	0.4	14	81	130	150
Chromium Hexavalent	3400*	650*	120	120	NE	<23	<21	<22	<26
Copper	46000*	62000*	2,900	2,900	5.4	3.2	19	1.7^{J}	12
Iron	NE	NE	NE	NE	*	2600	27000	16000	31000
Lead	970	1,300	230	230	$110^{P}/1,700^{SI}/16^{AV}/59^{M}$	3.1	57	0.17^{J}	36
Manganese	NE	NE	NE	NE	NE	4000	4800	1600	4900
Mercury	340	470	32	32	0.1	0.027^{JB}	0.05^{b}	1^{J}	0.037^{JB}
Molybdenum	NE	NE	NE	NE	NE	0.37^{J}	3.3^{J}	0.021^{JB}	5
Nickel	23,000	31,000	2,700	2,700	13.6	3.3	12	3	8.8
Selenium	5,700*	7,800*	53	53	0.0276	2.1	1.3	2	1.8
Silver	5,700*	7,800*	87	87	4.04	1^{J}	0.3^{J}	0.11^{J}	0.22^{J}
Thallium	80*	110*	10	10	0.0569	0.038^{J}	0.11^{J}	0.23^{J}	0.043^{J}
Tin	NE	NE	NE	NE	7.62	0.67^{JB}	5.3^{B}	0.68^{JB}	4.6^{B}
Vanadium	NE	NE	NE	NE	1.59	9.6	22	19	39
Zinc	340,000	470,000	38,000	10,000	6.62	38	230	8.5	170
Other Inorganics									
Cyanide, Total (mg/kg)	23,000	31,000	9.6	9.6	1.33^{W}	0.21	6	1.1	2.7
Organic Carbon, Total (%)	NE	NE	NE	NE	NE	0.65	18	3.5	3.2
Percent Moisture (%)	NE	NE	NE	NE	NE				
Phenolics, Total Rec (mg/kg)	NE	NE	NE	NE	NE	<0.42	3.6	1.2	0.84
Sulfide (mg/kg)	NE	NE	NE	NE	0.00358	1500	1900	130	1100

[1]IDEM - Indiana Department of Environmental Management, 2001, Risk Integrated System of Closure, Appendix 1 Table A - Default Closure Table - Industrial with 2006 and 2009 Table A updates
[2]EPA - US EPA Region V Ecological Screening Levels (August, 2003)
* Site specific value to be determined of pH if soils is <5 or >8.
^{J} - Estimated concentration between the method detection limit and quantitation limit
$^{M+}$ - Biased high due to matrix effect
$^{M-}$ - Biased low due to matrix effect
^{M} - Concentration estimated due to matrix effect
^{B} - Constituent in the laboratory method blank
^{P}-Plants/^{SI}=Soil Invertebrates/^{AV}=Avian/^{Ma}=Mammalian wildlife
NT = Not Tested
mg/kg = milligrams per kilogram

Table 6-2
Groundwater Measurements and Elevations
Clark Landfill , ArcelorMittal Indiana Harbor

Well Number & Data	MW-201S			MW-202S		MW-203S		MW-204S		West End of Intake Flume SW-201	
Ground Surface Elevation (ft msl)	598.2			601.0		585.1		597.3			
Top of PVC Casing Elevation (ft)	600.41			603.48		587.86		599.82		597.94	
Well Depth (Feet from TOC)[A]	28.00			31.00		18.00		26.00		—	
Date	Depth to LNAPL from TOC (ft)	Depth to GW from TOC (ft)	Groundwater Elevation (ft msl)	Depth to GW from TOC (ft)	Groundwater Elevation (ft msl)	Depth to GW from TOC (ft)	Groundwater Elevation (ft msl)	Depth to GW from TOC (ft)	Groundwater Elevation (ft msl)	Depth from MP* (ft)	Water Elevation (ft msl)
After Development	–	20.48	579.93	24	579.48	8.66	579.20	20.48	579.34	NM	
2-Mar-10	–	20.26	580.15	24.11	579.37	8.91	578.95	20.48	579.34	NM	
9-Mar-10	–	20.50	579.91	24.4	579.08	9.19	578.67	20.75	579.07	NM	
16-Mar-10	–	20.31	580.10	24.18	579.30	9.06	578.80	20.56	579.26	NM	
22-Mar-10	–	20.22	580.19	24.02	579.46	8.62	579.24	20.35	579.47	19.59	578.35
30-Mar-10	–	20.40	580.01	24.37	579.11	9.47	578.39	20.75	579.07	20.17	577.77
12-Apr-10	–	20.39	580.02	24.26	579.22	8.91	578.95	20.61	579.21	19.79	578.15
4-May-10	–	21.52	578.89	24.42	579.06	9.25	578.61	20.78	579.04	20.21	577.73
9-Jun-10	–	20.23	580.18	24.06	579.42	8.95	578.91	20.46	579.36	NM	
28-Jul-10	–	19.92	580.49	23.86	579.62	8.64	579.22	20.28	579.54	19.85	578.09
30-Aug-10	–	20.10	580.31	23.98	579.50	8.86	579.00	20.38	579.44	19.96	577.98
28-Oct-10	–	21.47	578.94	25.44	578.04	10.00	577.86	21.78	578.04	NM	
25-Jan-11	–	21.27	579.14	25.32	578.16	10.04	577.82	21.73	578.09	21	576.94
24-Feb-11	–	21.23	579.18	25.29	578.19	10.15	577.71	21.7	578.12	21.49	576.45
28-Mar-11	–	20.88	579.53	24.87	578.61	9.70	578.16	21.31	578.51	20.79	577.15
3-May-11	–	20.61	579.80	24.42	579.06	9.24	578.62	20.80	579.02	20.21	577.73
27-May-11	–	19.96	580.45	23.53	579.95	8.56	579.30	19.97	579.85	19.75	578.19
End											

Notes:

ft msl = Elevation referenced to feet above mean sea level using the National Geodetic Vertical Datum of 1929 (NGVD29)

TOC = Top of PVC Casing

ft = feet

[A] = as measured inside well

NI = Not Installed

-- No LNAPL measured

NM=Not Measured

*MP =measuring point-for surface water measurements

Table 6-3
Summary of Calculated Horizontal Gradients and Linear Velocity
Clark Landfill, East Chicago, IN
Project No. 60157738

Wells		Results			Calculation Data					
From Well (# 1)	To Well (# 2)	Gradient (feet per foot)	Linear Velocity[A] (feet/year)	Hydrogeologic Unit	Hydraulic Conductivity (cm/sec)[B]	Distance between wells (feet)	GW Elevation Well #1 (msl)[C]	GW Elevation Well #2 (msl)[C]	Effective Porosity[D]	Date of Groundwater Measurement
MW-201S	MW-203S	0.0008	1220	Slag-fill	1.19E-01	1340	580.02	578.95	0.25	April 2010
		0.0010	1493	Slag-fill	1.19E-01	1340	580.31	579.00	0.25	August 2010
		0.0008	1231	Slag-fill	1.19E-01	1340	578.94	577.86	0.25	October 2010
		0.0010	1505	Slag-fill	1.19E-01	1340	579.14	277.82	0.25	January 2011
		0.0009	1345	Slag-fill	1.19E-01	1340	579.80	578.62	0.25	May 2011
	Average	**0.0009**	**1359**							
MW-202S	MW-203S	0.0003	53	Slag-fill	2.01E-01	950	579.22	578.95	0.25	April 2010
		0.0005	437	Slag-fill	2.01E-01	950	579.50	579.00	0.25	August 2010
		0.0002	157	Slag-fill	2.01E-01	950	578.04	577.86	0.25	October 2010
		0.0004	297	Slag-fill	2.01E-01	950	578.16	577.82	0.25	January 2011
		0.0005	384	Slag-fill	2.01E-01	950	579.06	578.62	0.25	May 2011
	Average	**0.0004**	**266**							

Notes:

[A] Linear velocity represents the average rate at which water moves between two points: V=Ki/η, where V= linear velocity (ft/yr), K=hydraulic conductivity, i=gradient and η=effective porosity. Rounded to two significant figures.

[B] Hydraulic conductivity values listed are the geometric mean from the Hydraulic Conductivity Summary Table

[C] Groundwater elevations calculated from water level measurements and shown as feet above NGVD29 mean sea level.

[D] Effective porosity values estimated from soil textures listed in *Groundwater* by Freeze and Cherry (1979)

Table 6-4
Hydraulic Conductivity Summary
Clark Landfill - ArcelorMittal, Indiana Harbor

Well Identification	Hydraulic Conductivity				Screened Lithologic Unit	Solution Method
	Test 1	Test 2	Test 3	Geometric Mean		
	(cm/sec)					
MW-201S	2.5E-01	3.8E-01	1.9E-01	**2.6E-01**	Slag Fill	Bouwer-Rice (Unconfined)
MW-202S	9.5E-02	9.5E-02	9.5E-02	**9.5E-02**	Slag Fill	Bouwer-Rice (Unconfined)
MW-203S	1.8E-01	2.3E-01	2.3E-01	**2.1E-01**	Slag Fill	Bouwer-Rice (Unconfined)
MW-204S	9.7E-02	1.1E-02	5.0E-02	**3.8E-02**	Slag Fill	Bouwer-Rice (Unconfined)

Summary Statistics per Hydrostatic Unit (cm/sec.)

Hydrostatic Unit:	No. of Tests:	Minimum:	Maximum:	Geometric Mean:
Slag Fill	12	1.1E-02	3.8E-01	1.2E-01

Notes:
"n/a" indicates not applicable or that additional tests were not conducted at well.
Kv/Kh anisotropy ratio assumed to be 1.0

References:
1. Bouwer, H., 1989. The Bouwer and Rice slug test--an update, Ground Water, vol. 27, no. 3, pp. 304-309.
2. Bouwer, H. and R.C. Rice, 1976. A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells, Water Resour. Res., vol. 12, no. 3, pp. 423-428.

Table 6-5
Group B - Clark Landfill
Groundwater Laboratory Analytical Results

Parameters	CAS #	IDEM[1] GW Solubility (mg/L)	IDEM[1] MCL (mg/L)	IDEM[1] Industrial (mg/L)	IDEM[1] Default Closure Level (mg/L)	EPA[1] ESLs - water (mg/L)	Groundwater Samples B-MW201S-GW-(6-9-10) 6/9/2010	Groundwater Samples B-MW202S-GW-(6-9-10) 6/9/2010	Groundwater Samples B-MW203S-GW-(6-9-10) 6/9/2010	Groundwater Samples B-MW204S-GW-(6-9-10) 6/9/2010	Duplicate B-MW203S-GW-(6-9-10)D 6/9/2010	Field Blank B-MW203S-FB-(6-9-10) 6/9/2010	Rinsate Blank B-MW204S-RB-(6-9-10) 6/9/2010
VOCs (mg/L)													
1,1,1-Trichloroethane	74-55-6	1,300	0.2	29	29	0.076	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090
1,1,2,2-Tetrachloroethane	79-34-5	3,000	NE	0.014	0.014	0.38	< 0.0014	< 0.0014	< 0.0014	< 0.0014	< 0.0014	< 0.0014	< 0.0014
1,1-Dichloroethane	75-34-3	5,100	NE	10	10	0.047	< 0.00080	< 0.00080	0.0013 J	0.0012 J	0.0013 J	< 0.00080	< 0.00080
1,1-Dichloroethylene	75-35-4	2,200	0.007	5.1	5.1	0.065	< 0.0017	< 0.0017	< 0.0017	< 0.0017	< 0.0017	< 0.0017	< 0.0017
1,2-Dichloroethane	107-6-2	8,500	0.005	0.031	0.031	0.91	< 0.0012	< 0.0012	< 0.0012	< 0.0012	< 0.0012	< 0.0012	< 0.0012
1,2-Dichloropropane	75-87-5	2,800	0.005	0.042	0.042	0.36	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
1,3-Dichloropropane	142-28-9	NE	NE	NE	NE	NE	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090
2-Chloroethyl vinyl ether	110-75-8	NE	NE	NE	NE	NE	< 0.0023	< 0.0023	< 0.0023	< 0.0023	< 0.0023	< 0.0023	< 0.0023
Acrolein	107-02-8	210,000	NE	0.051	0.051	0.00019	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016	< 0.016
Acrylonitrile	107-13-1	NE	NE	NE	NE	0.066	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013	< 0.013
Benzene	71-43-2	1,800	0.005	0.052	0.052	0.114	0.0030 J	< 0.00080	0.051	< 0.00080	0.055	< 0.00080	< 0.00080
bis (Chloromethyl) ether	542-88-1	NE	NE	NE	NE	NE	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050	< 0.0050
Dichlorobromomethane	75-27-4	6,700	0.08	0.046	0.08	NE	< 0.00070	< 0.00070	< 0.00070	< 0.00070	< 0.00070	< 0.00070	< 0.00070
Bromoform	75-25-2	3,100	0.08	0.36	0.36	0.23	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080
Methyl Bromide (Bromomethane)	74-83-9	15,000	NE	0.14	0.14	0.016	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018	< 0.0018
Carbon tetrachloride	56-23-5	790	0.005	0.022	0.022	0.24	< 0.0017	< 0.0017	< 0.0017	< 0.0017	< 0.0017	< 0.0017	< 0.0017
Chlorobenzene	108-90-7	470	0.1	2	2	0.047	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080
Chloroethane	75-0-3	5,700	NE	0.99	0.99	NE	< 0.0023	< 0.0023	< 0.0023	< 0.0023	< 0.0023	< 0.0023	< 0.0023
Chloroform	67-66-3	7,900	0.08	1	1	0.14	0.0012 J	0.0017 J	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090
Methyl Chloride (Chloromethane)	74-87-3	NE	NE	NE	NE	NE	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010	< 0.0010
Chlorodibromomethane	124-48-1	NE	NE	NE	NE	NE	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080	< 0.00080
Dichlorodifluoromethane	75-71-8	NE	NE	NE	NE	NE	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Ethylbenzene	100-41-4	170	0.7	10	10	0.014	< 0.00090	< 0.00090	0.0010 J	< 0.00090	0.0011 J	< 0.00090	< 0.00090
Methylene chloride	75-9-2	13,000	0.005	0.38	0.38	0.94	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031	< 0.0031
Tetrachloroethylene	127-18-4	200	0.005	0.055	0.055	0.045	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.0013	< 0.0013
Toluene	108-88-3	530	1	8.2	8.2	0.253	< 0.00090	< 0.00090	0.033	< 0.00090	0.036	< 0.00090	< 0.00090
trans-1,2-Dichloroethylene	156-60-5	6,300	0.1	2	2	0.97	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Trichlorofluoromethane	75-69-4	1,100	NE	31	31	NE	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011	< 0.0011
Vinyl chloride	75-1-4	2,800	0.002	0.004	0.004	0.93	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090	< 0.00090
PAHs (mg/L)													
Acenaphthene	83-32-9	4.2	NE	6.1	6.1	0.038	0.000074 J	0.000020 JB	0.00081 J	0.00028 J	0.00064 J	0.000020 JB	< 0.000010
Acenaphthylene	208-96-8	3.9	NE	0.73	0.73	4.84	0.000053 J	< 0.000020	0.00082 J	0.00032 J	0.00030 J	< 0.000020	< 0.000021
Anthracene	120-12-7	0.043	NE	31	31	0.000035	< 0.000021	< 0.000020	0.00032 J	0.00021 J	0.00015 J	< 0.000020	< 0.000021
Benzo(a)anthracene	56-55-3	0.0094	NE	0.0039	0.0039	0.000025	< 0.000074	< 0.000071	< 0.000071	< 0.000074	< 0.000069	< 0.000071	< 0.000072
Benzo(a)pyrene	50-32-8	0.0016	0.0002	0.00039	0.00039	0.000014	< 0.000021	< 0.000020	< 0.000020	< 0.000021	< 0.000020	< 0.000020	< 0.000021
Benzo(b)fluoranthene	205-99-2	0.0015	NE	0.0039	0.0039	0.00907	< 0.000064	< 0.000061	< 0.000061	< 0.000064	< 0.000059	< 0.000061	< 0.000062
Benzo(g,h,I)perylene	191-24-2	NE	NE	NE	NE	0.00764	< 0.000021	< 0.000020	< 0.000020	< 0.000021	< 0.000020	< 0.000020	< 0.000021
Benzo(k)fluoranthene	207-8-9	0.0008	NE	0.039	0.039	NE	< 0.000011	< 0.000010	< 0.000010	< 0.000011	< 0.0000099	< 0.000010	0.000021 J
Chrysene	218-1-9	0.0016	NE	0.39	0.39	NE	< 0.000011	< 0.000010	0.000031 J	0.000021 J	0.000040 J	< 0.000010	0.000031 J
Dibenzo(a,h)anthracene	53-70-3	0.0025	NE	0.00039	0.00039	NE	< 0.000021	< 0.000020	< 0.000020	< 0.000021	< 0.000020	< 0.000020	< 0.000021
Fluoranthene	206-44-0	0.21	NE	4.1	4.1	0.0019	0.000053 J	0.000051 J	0.00055	0.00053	0.00050	< 0.000020	0.000031 J
Fluorene	86-73-7	2	NE	4.1	4.1	0.019	0.000096 J	< 0.000020	0.0015 J	0.00073 J	0.0013 J	0.000031 J	< 0.000021
Indeno (1,2,3-c,d) pyrene	193-39-5	0.000022	NE	0.0039	0.0039	0.00431	< 0.000017	< 0.000016	< 0.000016	< 0.000017	< 0.000016	< 0.000016	< 0.000016
Naphthalene	91-20-3	31	NE	2	2	0.013	0.00047 J	0.000020 JB	0.0091	0.0013	0.0062	0.000041 JB	0.000052 JB
Phenanthrene	85-1-8	1.2	NE	0.31	0.31	0.0036	0.00016 J	0.000031 JB	0.0033	0.0014	0.0028	0.000031 JB	0.000021 JB
Pyrene	129-0-0	0.14	NE	3.1	3.1	0.0003	< 0.000074	< 0.000071	0.00040 J	0.00056	0.00034 J	< 0.000071	< 0.000072

Table 6-5
Group B - Clark Landfill
Groundwater Laboratory Analytical Results

Parameters	CAS #	IDEM[1] GW Solubility (mg/L)	IDEM[1] MCL (mg/L)	IDEM[1] Industrial (mg/L)	IDEM[1] Default Closure Level (mg/L)	EPA[1] ESLs - water (mg/L)	Groundwater Samples: B-MW201S-GW-(6-9-10) 6/9/2010	Groundwater Samples: B-MW202S-GW-(6-9-10) 6/9/2010	Groundwater Samples: B-MW203S-GW-(6-9-10) 6/9/2010	Groundwater Samples: B-MW204S-GW-(6-9-10) 6/9/2010	Duplicate: B-MW203S-GW-(6-9-10)D 6/9/2010	Field Blank: B-MW203S-FB-(6-9-10) 6/9/2010	Rinsate Blank: B-MW204S-RB-(6-9-10) 6/9/2010
SVOCs (mg/L)													
1,2,4-Trichlorobenzene	120-82-1	300	0.07	1	1	0.030	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
1,2-Dichlorobenzene	95-50-1	160	0.6	9.2	9.2	0.014	< 0.00074	< 0.00071	< 0.00071	< 0.00074	< 0.00069	< 0.00071	< 0.00072
1,2-Diphenylhydrazine	122-66-7	NE	NE	NE	NE	NE	< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
1,4-Dichlorobenzene	106-46-7	74	0.075	0.12	0.012	0.0094	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
2,4,6-Trichlorophenol	88-6-2	800	NE	0.01	0.01	0.0049	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
2,4-Dichlorophenol	120-83-2	4,500	NE	0.31	0.31	0.011	< 0.00074	< 0.00071	< 0.00071	< 0.00074	< 0.00069	< 0.00071	< 0.00072
2,4-Dimethylphenol	105-67-9	7,900	NE	2	2	0.1	< 0.00085	< 0.00082	< 0.00082	< 0.00085	< 0.00079	< 0.00082	< 0.00082
2,4-Dinitrophenol	51-28-5	2,800	NE	0.2	0.2	0.019	< 0.010	< 0.0096	< 0.0096	< 0.010	< 0.0093	< 0.0096	< 0.0097
2,4-Dinitrotoluene	121-14-2	NE	NE	NE	NE	0.044	< 0.00085	< 0.00082	< 0.00082	< 0.00085	< 0.00079	< 0.00082	< 0.00082
2,6-Dinitrotoluene	606-20-2	NE	NE	NE	NE	0.081	< 0.0012	< 0.0011	< 0.0011	< 0.0012	< 0.0011	< 0.0011	< 0.0011
2-Chloronaphthalene	91-58-7	12	NE	8.2	8.2	0.000396	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
2-Chlorophenol	95-57-8	22,000	NE	0.51	0.51	0.024	< 0.00074	< 0.00071	< 0.00071	< 0.00074	< 0.00069	< 0.00071	< 0.00072
2-Nitrophenol (o-Nitrophenol)	88-75-5	NE	NE	NE	NE	NE	< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
3,3-Dichlorobenzidine	91-94-1	3.1	NE	0.0064	0.0064	0.0045	< 0.00074	< 0.00071	< 0.00071	< 0.00074	< 0.00069	< 0.00071	< 0.00072
4,6-Dinitro-o-cresol	534-52-1	NE	NE	NE	NE	0.023	< 0.0012	< 0.0011	< 0.0011	< 0.0012	< 0.0011	< 0.0011	< 0.0011
4-Bromophenyl phenyl ether	101-55-3	NE	NE	NE	NE	0.0015	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
4-Chloro-3-methylphenol	59-50-7	NE	NE	NE	NE		< 0.0013	< 0.0012	< 0.0012	< 0.0013	< 0.0012	< 0.0012	< 0.0012
4-Chlorophenyl phenyl ether	7005-72-3	NE	NE	NE	NE	NE	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
4-Nitrophenol (p-Nitrophenol)	100-02-7	NE	NE	NE	NE	0.06	< 0.0046	< 0.0044	< 0.0044	< 0.0046	< 0.0043	< 0.0044	< 0.0044
Benzidine	92-87-5	NE	NE	NE	NE	NE	< 0.038	< 0.036	< 0.036	< 0.038	< 0.035	< 0.036	< 0.037
bis(2-Chloroethoxy)methane	111-91-1	NE	NE	NE	NE	NE	< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
bis(2-Chloroethyl)ether	111-44-4	17,000	NE	0.0026	0.0026	19	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
bis(2-Ethylhexyl)phthalate	117-81-7	0.34	0.006	0.2	0.2	0.0003	< 0.0012	< 0.0011	< 0.0011	< 0.0012	< 0.0011	< 0.0011	< 0.0011
Butylbenzylphthalate	85-68-7	2.7	NE	20	2.7	0.023	< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
Diethylphthalate	84-66-2	1,100	NE	82	82	0.11	< 0.0012	< 0.0011	< 0.0011	< 0.0012	< 0.0011	< 0.0011	< 0.0011
Dimethylphthalate	131-11-3	4,000	NE	1,000	1,000	NE	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
Di-n-butylphthalate	84-74-2	11	NE	10	10	0.0097	< 0.0013	< 0.0012	< 0.0012	< 0.0013	< 0.0012	< 0.0012	< 0.0012
Di-n-octylphthalate	117-84-0	0.02	NE	2	0.02	0.030	< 0.0012	< 0.0011	< 0.0011	< 0.0012	< 0.0011	< 0.0011	< 0.0011
Hexachlorobenzene	118-74-1	6.2	0.001	0.0018	0.0018	$3X10^{-7}$	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
Hexachlorobutadiene	87-68-3	3.2	NE	0.02	0.02	0.000053	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
Hexachlorocyclopentadiene	77-47-4	1.80	0.05	0.61	0.61	0.077	< 0.00064	< 0.00061	< 0.00061	< 0.00064	< 0.00059	< 0.00061	< 0.00062
Hexachloroethane	67-72-1	50	NE	0.1	0.1	0.008	< 0.00096	< 0.00092	< 0.00092	< 0.00096	< 0.00089	< 0.00092	< 0.00093
Isophorone	78-59-1	12,000	NE	3	3	0.92	< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
Nitrobenzene	98-95-3	2,100	NE	0.051	0.051		< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
N-Nitrosodimethylamine	62-75-9	NE	NE	NE	NE	NE	< 0.00074	< 0.00071	< 0.00071	< 0.00074	< 0.00069	< 0.00071	< 0.00072
N-Nitroso-di-n-propylamine	621-64-7	9,900	NE	0.00041	0.00041	NE	< 0.0011	< 0.0010	< 0.0010	< 0.0011	< 0.00099	< 0.0010	< 0.0010
N-Nitrosodiphenylamine	86-30-6	35	NE	0.58	0.58	NE	< 0.00074	< 0.00071	< 0.00071	< 0.00074	< 0.00069	< 0.00071	< 0.00072
Pentachlorophenol	87-86-5	2,000	0.001	0.024	0.024	0.004	< 0.0014	< 0.0013	< 0.0013	< 0.0014	< 0.0013	< 0.0013	< 0.0013
Phenol	108-95-2	83,000	NE	31	31	0.180	< 0.00043	< 0.00041	< 0.00041	< 0.00043	< 0.00040	< 0.00041	< 0.00041

Table 6-5
Group B - Clark Landfill
Groundwater Laboratory Analytical Results

Parameters	CAS #	IDEM[1] GW Solubility (mg/L)	IDEM[1] MCL (mg/L)	IDEM[1] Industrial (mg/L)	IDEM[1] Default Closure Level (mg/L)	EPA[1] ESLs - water (mg/L)	Groundwater Samples: B-MW201S-GW-(6-9-10) 6/9/2010	B-MW202S-GW-(6-9-10) 6/9/2010	B-MW203S-GW-(6-9-10) 6/9/2010	B-MW204S-GW-(6-9-10) 6/9/2010	Duplicate: B-MW203S-GW-(6-9-10)D 6/9/2010	Field Blank: B-MW203S-FB-(6-9-10) 6/9/2010	Rinsate Blank: B-MW204S-RB-(6-9-10) 6/9/2010
Total Metals (mg/L)													
Antimony	7440-36-0	NE	0.006	0.041	0.041	0.08	0.0017 J	< 0.00030	< 0.00030	< 0.00030	< 0.00030	< 0.00030	< 0.00030
Arsenic	7440-38-2	NE	0.01	0.0019	0.01	0.148	0.0034 J	0.0025 J	0.0010 J	0.0013 J	0.0010 J	< 0.0010	< 0.0010
Beryllium	7440-41-7	NE	0.004	0.2	0.2	0.0036	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Boron	7440-42-8	NE	NE	NE	NE	NE	0.13	0.18	0.28	0.18	0.28	0.012 J	0.0058 J
Cadmium	7440-43-9	NE	0.005	0.051	0.051	0.00015	< 0.000050	< 0.000050	< 0 000050	< 0.000050	< 0.000050	0.00077 J	< 0.000050
Chromium	7440-47-3	NE	0.1	150	150	0.042	0.0011 JB	0.069	0.0016 JB	0.0012 JB	0.0019 JB	0.0026 JB	0.0013 JB
Chromium, hexavalent	18540-29-9	NE	0.1	0.31	0.31	NE	< 0.0030	0.067	< 0.0030	< 0.0030	< 0.0030	0.0068 J	0.0058 J
Copper	7440-50-8	NE	1.3	4.1	4.1	0.00158	< 0.0020	0.0021 J	< 0.0020	< 0.0020	< 0.0020	0.0024 J	0.0023 J
Iron	7439-89-6	NE	NE	NE	NE	NE	< 0.021	0.070	0.064	< 0.021	0.055	< 0.021	< 0 021
Lead	7439-92-1	NE	0.015	0.042	0.042	0.00117	0.00025 J	0.0015 J	0.00021 J	< 0.00020	< 0.00020	0.00062 J	< 0.00020
Manganese	7439-96-5	NE	NE	NE	NE	NE	0.027	0.016	0.0014 J	< 0.00030	0.0012 J	< 0 00030	< 0.00030
Mercury	7439-97-6	69,000	0.002	0.031	0.031	1.3X10^{-6}	< 0.000040	< 0.000040	< 0.000040	< 0.000040	< 0.000040	< 0.000040	< 0.000040
Molybdenum	7439-98-7	NE	NE	NE	NE	NE	0.011 J	0.030	0.027	0.028	0.026	0.00076 JB	0.00029 JB
Nickel	7440-2-0	NE	NE	2	2	0.0289	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
Selenium	7782-49-2	NE	0.05	0.51	0.51	0.005	0.0033 J	0.0081	0.0031 J	0.0036 J	0.0032 J	< 0.00040	< 0.00040
Silver	7440-22-4	NE	NE	0.51	0.51	0.00012	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Sodium	7440-23-5	NE	NE	NE	NE	NE	24	170	47	78	47	0.26 J	0.19 J
Thallium	7440-28-0	NE	0.002	0.0072	0.0072	0.01	0.0034	0.0015 J	0.00068 J	0.00021 J	0.00034 J	0.00023 J	< 0.00020
Tin	7440-31-5	NE	NE	NE	NE	0.18	0.0049 J	0.0072 J	0.0029 J	0.00042 J	0.0014 J	0.00099 J	0.00025 J
Vanadium	7440-62-2	NE	NE	NE	NE	0.012	0.0050 J	0.0054 J	0.0010 J	0.0026 J	< 0.00080	0.0011 J	< 0.00080
Zinc	7440-66-6	NE	NE	31	31	0.0657	< 0.0040	< 0.0040	0.0062 J	0.027	< 0.0040	0.0048 JB	< 0.0040
Dissolved Metals (mg/L)													
Antimony, Dis.	*7440-36-0*	*NE*	*0.006*	*0.041*	*0.041*	*0.08*	0.0014 J	< 0.00030	< 0.00030	< 0.00030	< 0.00030	< 0 00030	< 0 00030
Arsenic, Dis.	*7440-38-2*	*NE*	*0.01*	*0.0019*	*0.01*	*0.148*	0.0018	0.0017	< 0.0010	0.0014	< 0.0010	< 0.0010	< 0.0010
Beryllium, Dis.	*7440-41-7*	*NE*	*0.004*	*0.2*	*0.2*	*0.0036*	< 0.00010	< 0.00010	< 0 00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Boron, Dis.	*7440-42-8*	*NE*	*NE*	*NE*	*NE*	*NE*	0.11	0.15	0.26	0.17	0.26	0.0078 J	0.0051 J
Cadmium, Dis.	*7440-43-9*	*NE*	*0.005*	*0.051*	*0.051*	*0.00015*	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050	< 0.000050
Chromium, Dis.	*7440-47-3*	*NE*	*0.1*	*150*	*150*	*0.042*	0.0018 JB	0.077	0.0014 JB	0.0019 JB	0.0035 B	0.0021 JB	0.0026 JB
Copper, Dis.	*7440-50-8*	*NE*	*1.3*	*4.1*	*4.1*	*0.00158*	< 0.0020	0.0022 J	< 0.0020	< 0.0020	< 0.0020	0.0026 J	0.0026 J
Iron, Dis.	*7439-89-6*	*NE*	*NE*	*NE*	*NE*	*NE*	< 0.021	0.029 J	0.047 J	0.025 J	0.054	< 0.021	< 0.021
Lead, Dis.	*7439-92-1*	*NE*	*0.015*	*0.042*	*0.042*	*0.00117*	0.00021 J	0.0013 J	< 0.00020	< 0.00020	< 0.00020	< 0.00020	0.00022 J
Manganese, Dis.	*7439-96-5*	*NE*	*NE*	*NE*	*NE*	*NE*	0.030	0.0044	0.00047 J	0.0011 J	0.00099 J	< 0.00030	0.00031 J
Mercury, Dis.	*7439-97-6*	*69,000*	*0.002*	*0.031*	*0.031*	*1.3X10^{-6}*	< 0.000040	< 0.000040	< 0.000040	< 0.000040	< 0.000040	< 0.000040	< 0.000040
Molybdenum, Dis.	*7439-98-7*	*NE*	*NE*	*NE*	*NE*	*NE*	0.0068 J	0.026	0.025	0.026	0.024	0.00030 JB	0.00025 JB
Nickel, Dis.	*7440-2-0*	*NE*	*NE*	*2*	*2*	*0.0289*	< 0.00020	< 0.00020	< 0.00020	< 0.00020	0.00034 J	< 0.00020	< 0.00020
Selenium, Dis.	*7782-49-2*	*NE*	*0.05*	*0.51*	*0.51*	*0.005*	0.0016 J	0.0066	0.0032 J	0.0037 J	0.0035 J	< 0.00040	0.00062 J
Silver, Dis.	*7440-22-4*	*NE*	*NE*	*0.51*	*0.51*	*0.00012*	< 0 00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Sodium, Dis.	*7440-23-5*	*NE*	*NE*	*NE*	*NE*	*NE*	24	160	46	70	46	0.18 J	0.18 J
Thallium, Dis.	*7440-28-0*	*NE*	*0.002*	*0.0072*	*0.0072*	*0.01*	0.00059 J	0.00024 J	< 0.00020	< 0.00020	< 0.00020	< 0.00020	< 0.00020
Tin, Dis.	*7440-31-5*	*NE*	*NE*	*NE*	*NE*	*0.18*	0.0012 J	0.00075 J	0.00056 J	< 0.00020	0.00042 J	0.00025 J	< 0.00020
Vanadium, Dis.	*7440-62-2*	*NE*	*NE*	*NE*	*NE*	*0.012*	0.0040 J	0.0055 J	< 0.00080	0.0033 J	< 0.00080	< 0.00080	0.0013 J
Zinc, Dis.	*7440-66-6*	*NE*	*NE*	*31*	*31*	*0.0657*	0.0077 JB	0.0061 JB	< 0.0040	< 0.0040	0.0042 JB	0.0049 JB	0.0073 JB

Table 6-5
Group B - Clark Landfill
Groundwater Laboratory Analytical Results

Parameters	CAS #	IDEM[1] GW Solubility (mg/L)	IDEM[1] MCL (mg/L)	IDEM[1] Industrial (mg/L)	IDEM[1] Default Closure Level (mg/L)	EPA[1] ESLs - water (mg/L)	Groundwater Samples B-MW201S-GW-(6-9-10) 6/9/2010	Groundwater Samples B-MW202S-GW-(6-9-10) 6/9/2010	Groundwater Samples B-MW203S-GW-(6-9-10) 6/9/2010	Groundwater Samples B-MW204S-GW-(6-9-10) 6/9/2010	Duplicate B-MW203S-GW-(6-9-10)D 6/9/2010	Field Blank B-MW203S-FB-(6-9-10) 6/9/2010	Rinsate Blank B-MW204S-RB-(6-9-10) 6/9/2010
Other (mg/L)													
Alkalinity, Bicarbonate (As CaCO3)	None	NE	NE	NE	NE	NE	73	< 2.0	< 2.0	< 2.0	< 2.0	2.0 J	< 2.0
Alkalinity, Carbonate (As CaCO3)	None	NE	NE	NE	NE	NE	12 J	80	40	40	40	< 2.0	< 2.0
Alkalinity, Hydroxide (As CaCO3)	None	NE	NE	NE	NE	NE	< 2.0	210	280	220	300	< 2.0	< 2.0
Alkalinity, Total (As CaCO3)	None	NE	NE	NE	NE	NE	85	290	320	260	340	2.0 J	< 2.0
Chloride	16887-00-6	NE	NE	NE	NE	NE	34	210	74	110	72	< 1.0	< 1.0
Chemical Oxygen Demand	None	NE	NE	NE	NE	NE	< 7.8	< 7.8	27	8.4 J	14	< 7.8	< 7.8
Cyanide, Total	57-12-5	NE	NE	NE	NE	0.0052	< 0.0014	< 0.0014	0.068	< 0.0014	0.094	< 0.0014	< 0.0014
Hardness	None	NE	NE	NE	NE	NE	130	400	440	340	450	< 1 6	< 1.6
Nitrogen, Ammonia (As N)		NE	NE	NE	NE	NE	0.33	0.27	2.5	1.6	2.6	< 0.080	0.13
Phenolics, Total Recoverable	None	NE	NE	NE	NE	0.18	< 0.0050	< 0.0050	0.020	< 0.0050	0.025	< 0.0050	< 0.0050
Sulfate		NE	NE	NE	NE	NE	65	200	130	150	140	7.6 J	< 0.40
Sulfide	18496-25-8	NE	NE	NE	NE	NE	1.2	< 0.014	10	2.5	13	< 0.014	< 0.014
Total Organic Carbon	None	NE	NE	NE	NE	NE	1.9	1.1	2.4	1.6	2.8	< 0.5	< 0.5
Total Dissolved Solids (Residue)		NE	NE	NE	NE	NE	200	880	620	580	630	< 18	< 18

[1]IDEM - Indiana Department of Environmental Management, 2001, Risk Integrated System of Closure, Appendix 1 Table A - Default Closure Table - Industrial with 2006 and 2009 Table A updates
[2]EPA - US EPA Region V Ecological Screening Levels (August, 2003)
[J] - Estimated concentration between the method detection limit and quantitation limit
[M+] - Biased high due to matrix effect
[M-] - Biased low due to matrix effect
[M] - Concentration estimated due to matrix effect
[B] - Constituent in the laboratory method blank
[E] = Estimated value, holding time exceeded
NP = Not Perfomed
mg/L = milligram per liter
NE = Not Established

Table 6-6
Summary of Measured Groundwater Field Parameters
Clark Landfill, ArcelorMittal Indiana Harbor

Monitoring Well Information				Field Parameters				
Well	Zone	Area	Date of Sample	Temper-ature (°C)	pH (pH units)	Conduct-ivity (mS/cm)	ORP (mV)	Turbidity (ntu)
MW-201S	WT	B	6/9/2010	21.0	9.21	0.36	-207	5
MW-202S	WT	B	6/9/2010	18.1	11.83	2.23	-113	2
MW-203S	WT	B	6/9/2010	19.6	11.80	2.01	-336	12
MW-204S	WT	B	6/9/2010	18.0	11.56	1.58	-240	5

NM = Not Measured

D = Screened at base of Calumet Sand

°C = degrees celcius

mV = Millivolts

WT = Screened across the water table

mS/cm = Micromhos per centimeter

ntu = Nephelometric Turbidity Units

Table 6-7
Groundwater Results above DQOs
Clark Landfill

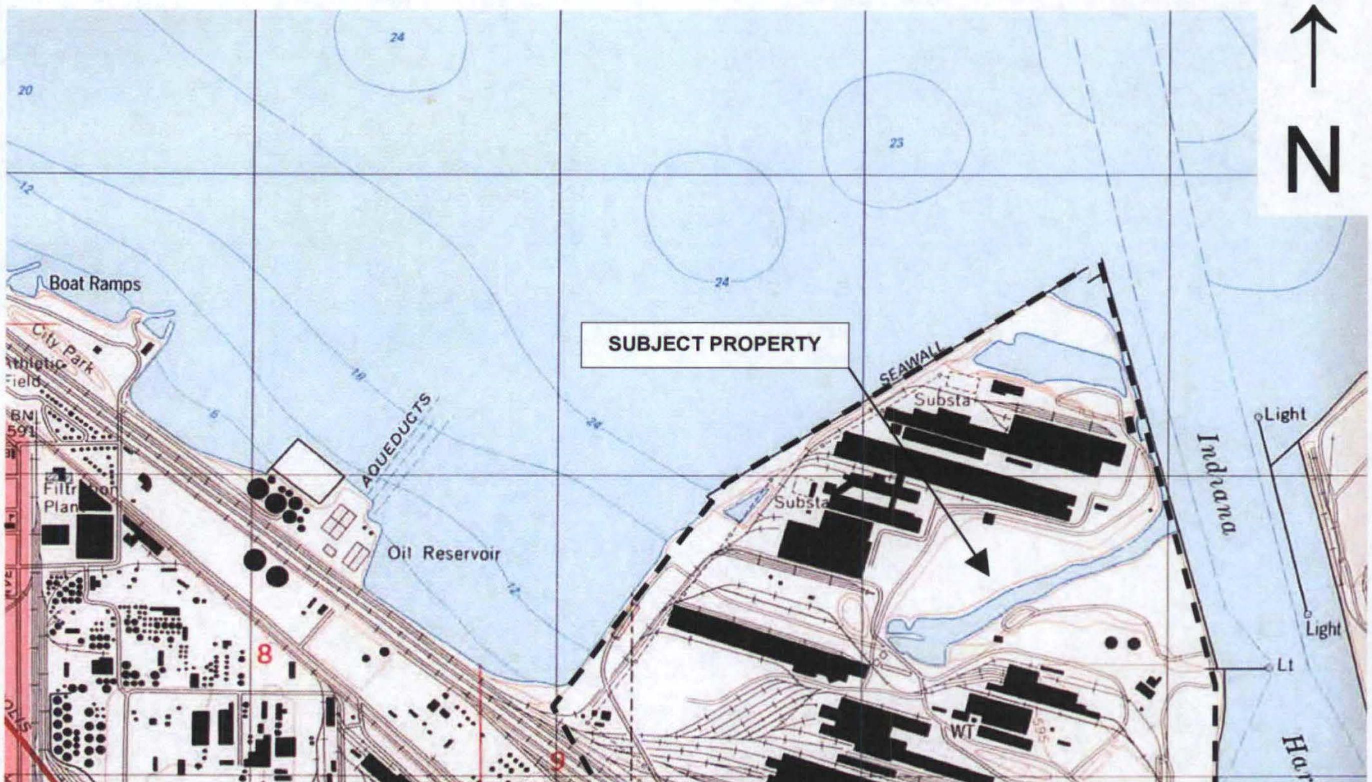
Sorted by Analyte

Groundwater Sampling Results										Screening Criteria/Data Quality Objectives - Industrial			
Area	Location	Date	Analyte	CAS	Units	Results	RLimit	MDL	Qual-ifier	IDEM Groundwater Solubility	IDEM MCL	IDEM Groundwater Industrial	IDEM Groundwater Default Closure
B	MW201S	09-Jun-10	Arsenic	7440-38-2	mg/L	0.0034	0.01	0.001	J			0.0019	
B	MW202S	09-Jun-10	Arsenic	7440-38-2	mg/L	0.0025	0.01	0.001	J			0.0019	
B	MW203S	09-Jun-10	Benzene	71-43-2	mg/L	0.051	0.005	0.0008			0.005		
B	MW203S-Dup	09-Jun-10	Benzene	71-43-2	mg/L	0.055	0.005	0.0008			0.005	0.052	0.052
B	MW201S	09-Jun-10	Thallium	7440-28-0	mg/L	0.0034	0.002	0.0002			0.002		

Sorted by Location

Groundwater Sampling Results										Screening Criteria/Data Quality Objectives - Industrial			
Area	Location	Date	Analyte	CAS	Units	Results	RLimit	MDL	Qual-ifier	IDEM Groundwater Solubility	IDEM MCL	IDEM Groundwater Industrial	IDEM Groundwater Default Closure
B	MW201S	09-Jun-10	Arsenic	7440-38-2	mg/L	0.0034	0.01	0.001	J			0.0019	
B	MW201S	09-Jun-10	Thallium	7440-28-0	mg/L	0.0034	0.002	0.0002			0.002		
B	MW202S	09-Jun-10	Arsenic	7440-38-2	mg/L	0.0025	0.01	0.001	J			0.0019	
B	MW203S	09-Jun-10	Benzene	71-43-2	mg/L	0.051	0.005	0.0008			0.005		
B	MW203S-Dup	09-Jun-10	Benzene	71-43-2	mg/L	0.055	0.005	0.0008			0.005	0.052	0.052

Figures



Source: USGS 7.5 Minute Topographic Map, Whiting, IN 1998

AECOM	SITE LOCATION CLARK LANDFILL ARCELORMITTAL INDIANA HARBOR EAST CHICAGO, INDIANA	DRAWN BY: GMB	DATE: 6-8-11
		CHECKED BY: LLA	DATE: 6-8-11
		APPROVED BY: SCK	DATE: 6-8-11
		FILE NO.: Clark-topo	SCALE : 1:24000
		PROJECT NO. **60157738**	FIGURE NO. **1-1**

AECOM

11425 W. Lake Park Drive
Suite 100, Milwaukee, WI 53224
T 414.359.3030
www.aecom.com

Approximate boundary of the Clark Landfill

SITE LAYOUT
CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOE
EAST CHICAGO, INDIANA

Drawn:	dd 3-2-11
Checked:	lla 6-8-11
Approved:	sck 6-8-11
PROJECT NUMBER	60157738
FIGURE NUMBER	1-2

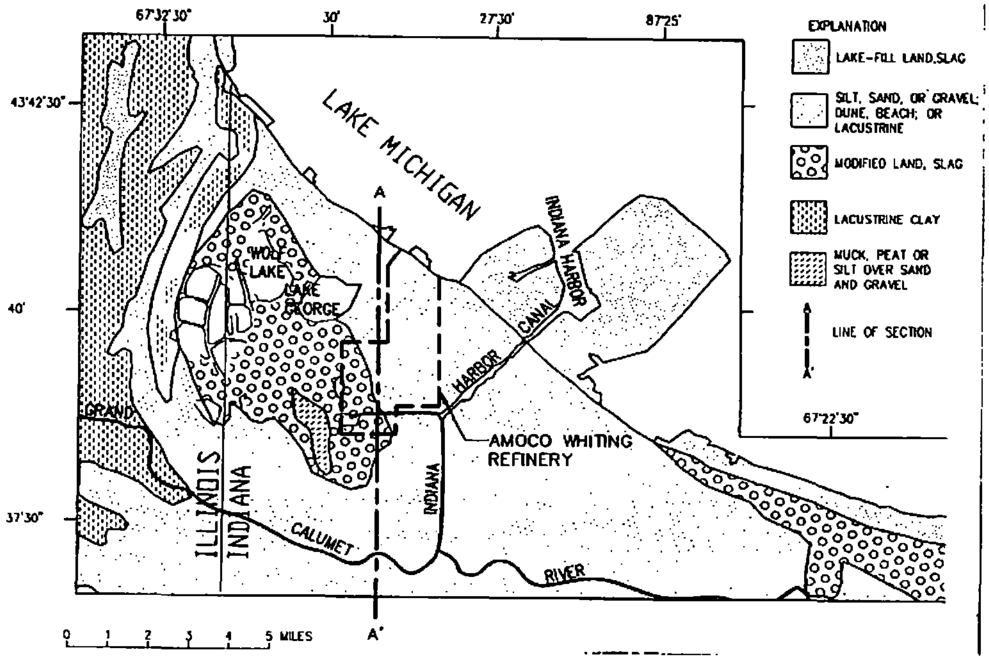
Figure 1-3
Conceptual Site Model Diagram Group B Clark Landfill
ArcelorMittal Indiana Harbor LLC

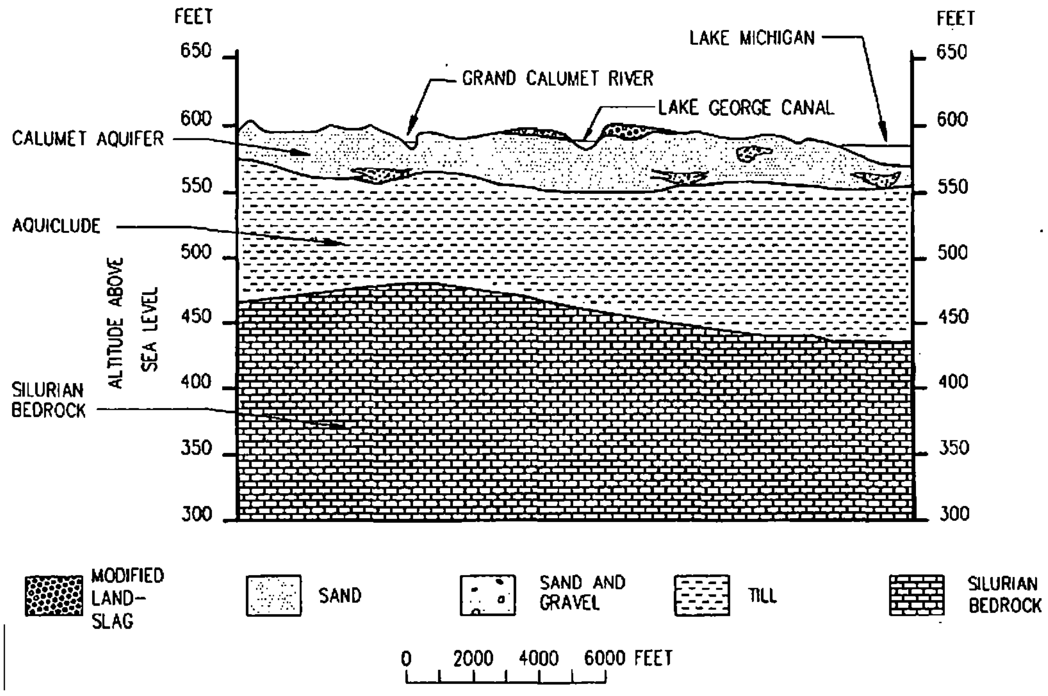
Primary Source	Primary Release Mechanism	Secondary Source	Secondary Release Mechanism	Contact Medium	Exposure Route	Receptor: Human: Current Site Worker	Receptor: Human: Future Site Worker	Receptor: Biota: Terrestrial[B]	Receptor: Biota: Aquatic
The Clark Landfill	Percolation			Surface Slag-Fill	Ingestion	X	X	X	X
					Direct Contact	X	X	X	X
	Percolation	Subsurface Slag-Fill	Percolation	Groundwater	Ingestion	X	X	X	X
					Direct Contact	X	X	X	X
				Intake Flume/Indiana Harbor Canal	Ingestion	X	X	X	X
					Direct Contact	O	O	X	X
				Subsurface Slag-Fill/Soil	Ingestion	X	X	X	X
					Direct Contact	X	X	X	X

Notes:

O = Incomplete or negligilbe exposure pathway
● = Exposure pathway complete
X = Exposure pathway incomplete

[A] Site model diagram taken from "*Data Quality Objectives Process for Hazardous Waste Site Investigations*", EPA QA/G-4HW, January 2000.
[B] Terrestrial receptors include: soil biota, omnivore and carnivore birds. Chemical movement in foodchains is not presented since no plans for direct sampling of these media currently exist.





Modified after Watson. 1988

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SURFICIAL GEOLOGY MAP AND GEOLOGIC CROSS SECTION NORTHWEST INDIANA

Drawn:	GMB	6-1-11
Checked:	LLA	6-3-11
Approved:	SCK	6-10-11
PROJECT NUMBER	60157738	
FIGURE NUMBER	3-1	

SYSTEM	STRATIGRAPHIC UNITS		DOMINANT LITHOLOGY	THICKNESS IN FEET
QUATERNARY	Glacial drift		Sand, gravel, and clay	55 – 210
DEVONIAN	Antrim Shale		Shale	0 – 135
	Traverse Fm.		Limestone	0 – 135
SILURIAN	Detroit River Fm. Salina Fm. Wabash Fm. Louisville Ls. Salamonie Dol. Brassfield Ls.		Dolomite and limestone	380 – 555
ORDOVICIAN	Maquoketa Gr.		Shale and limestone	170 – 285
	Trenton Ls. Black River Ls.		Limestone and dolomite	320 – 370
	St. Peter Ss.		Sandstone	30 – 325
	Knox Dol.		Dolomite	65 – 625
CAMBRIAN	Galesville Ss.		Sandstone and dolomite	65 – 150
			Sandstone	165 – 215
	Eau Claire Fm.		Shale, dolomite, and sandstone	540 – 620
	"B" cap		Shale	
	Mount Simon Ss.		Sandstone	1,600 – 2,000
PRE-CAMBRIAN			Granite	

after Hartke, Hill and Reshkin, 1975

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BEDROCK GEOLOGY
STRATIGRAPHIC COLUMN

Drawn:	LLA	06-16-11
Checked:	LLA	06-16-11
Approved:	SCK	06-20-11
PROJECT NUMBER	60157738	
FIGURE NUMBER	3-2	

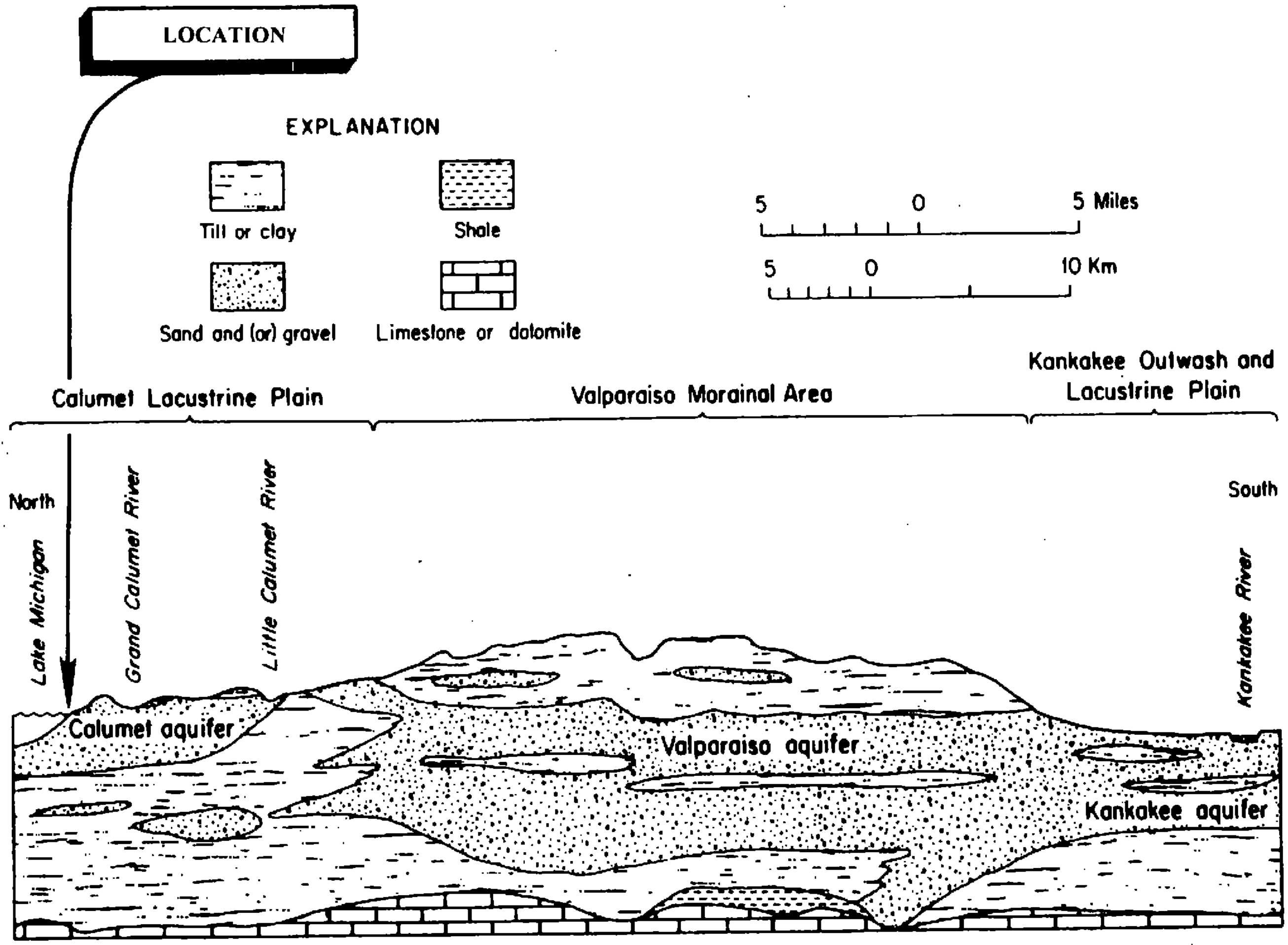

FIGURE 4.0-3 **Idealized north-south cross section through Lake County showing positions of unconsolidated aquifers.**

Source: HARTKE et al., 1975.

after Hartke, Hill and Reshkin, 1975

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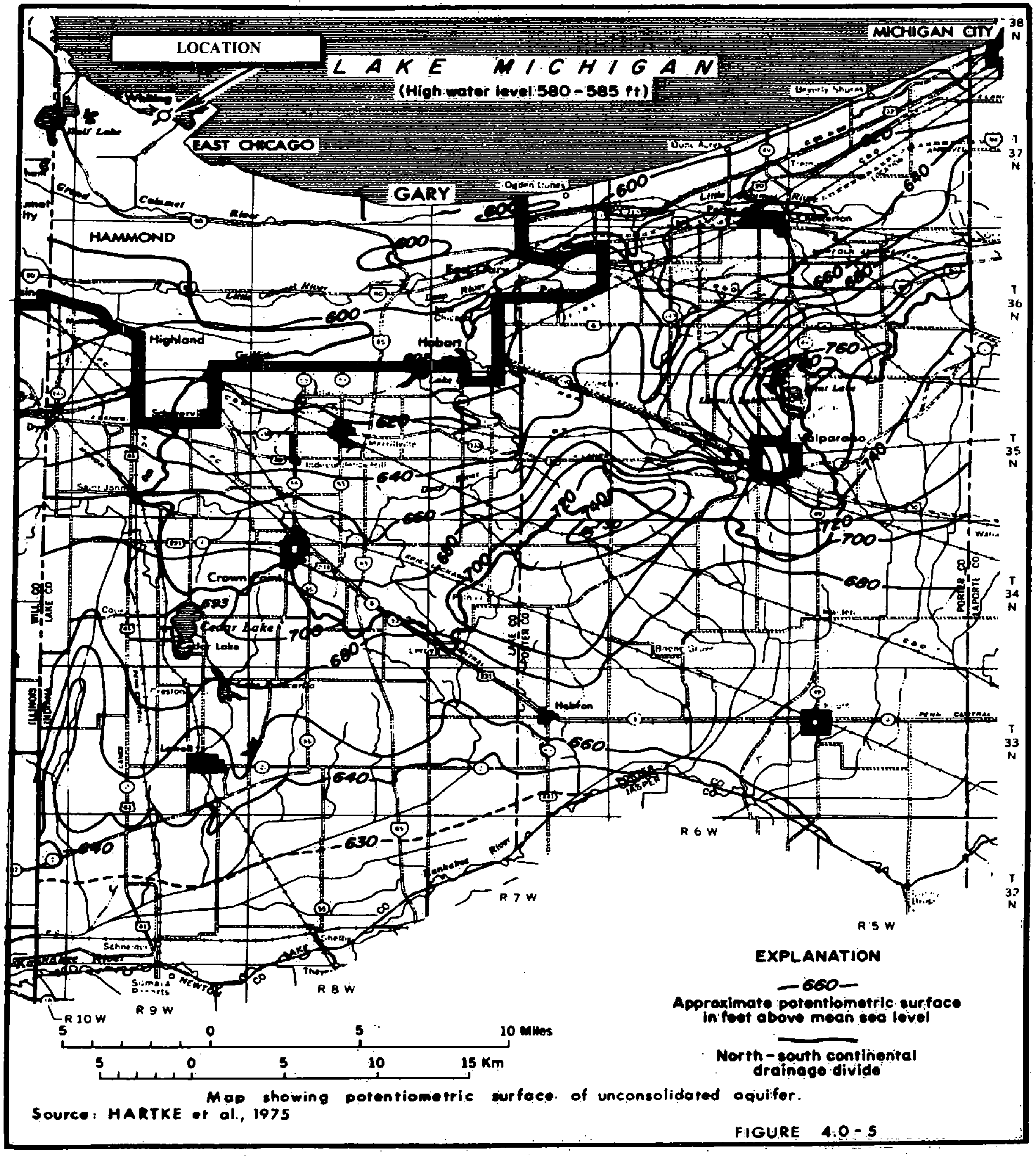
IDEALIZED NORTH-SOUTH CROSS SECTION THROUGH LAKE COUNTY
SHOWING POSITIONS OF UNCONSOLIDATED AQUIFERS

Drawn:	LLA 6-16-11
Checked:	LLA 6-16-11
Approved:	SCK 6-20-11
PROJECT NUMBER	60157738
FIGURE NUMBER	3-3



after Hartke, Hill and Reshkin, 1975

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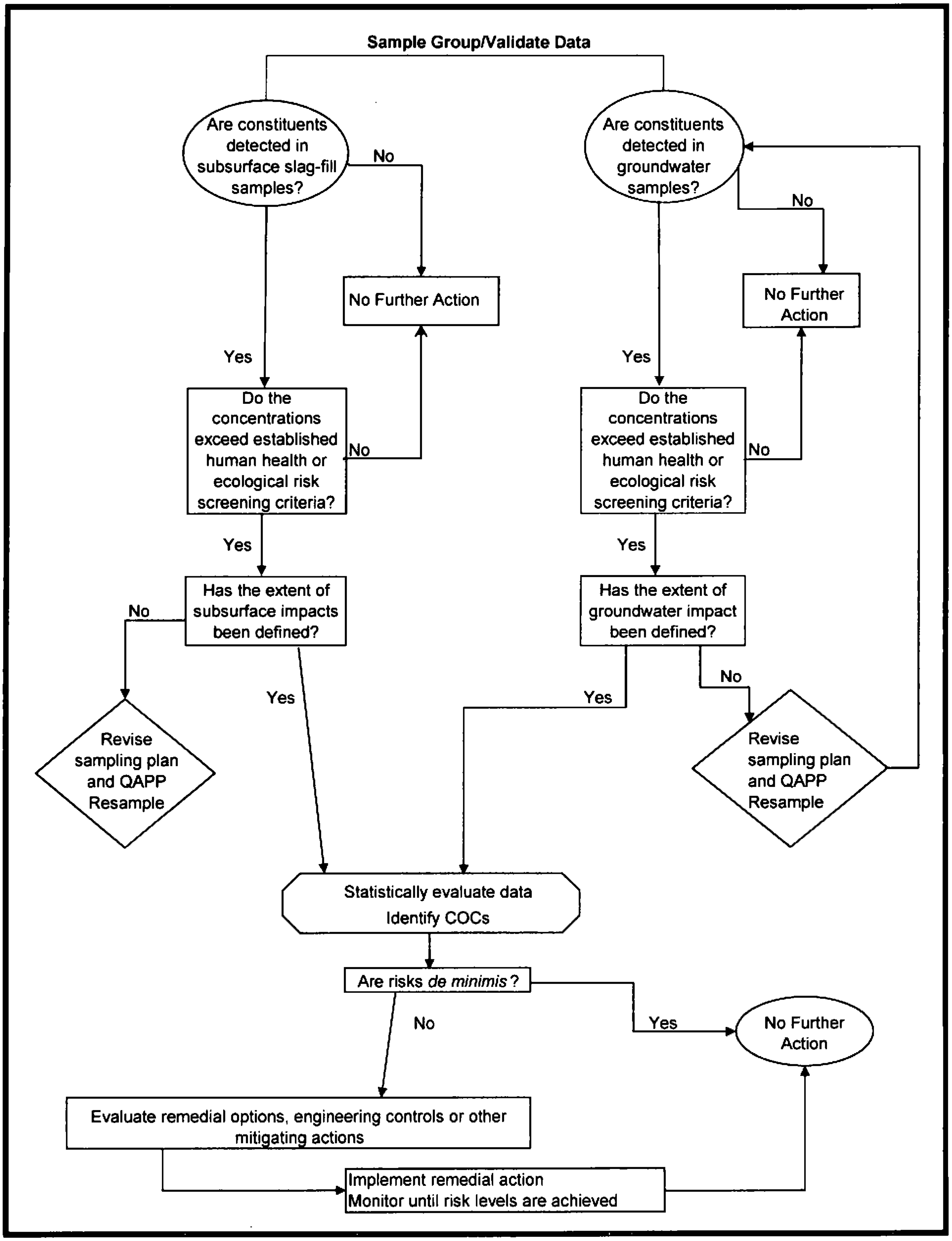
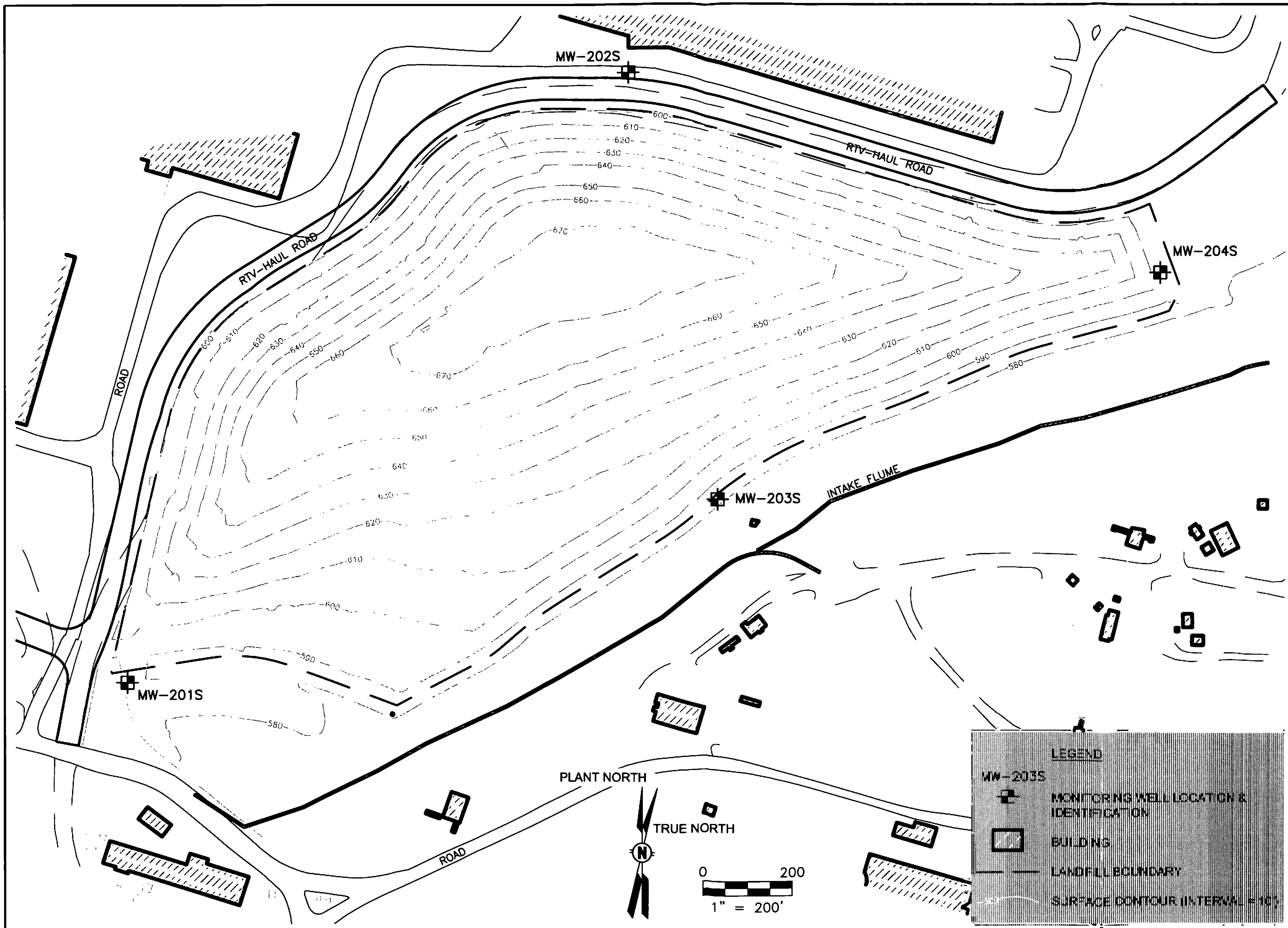
POTENTIOMETRIC SURFACE OF THE
UNCONSOLIDATED AQUIFER
LAKE AND PORTER COUNTIES, INDIANA

Drawn:	LLA	6/16/2011
Checked:	LLA	6/16/2011
Approved:	SCK	6/16/2011
PROJECT NUMBER	60157738	
FIGURE NUMBER	3-4	

Figure 4-1
Investigation Decision Flow Chart
Clark Landfill, ArcelorMittal Indiana Harbor, LLC





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MONITORING WELL LOCATIONS
CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC. (WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH	9/15/2010
Checked:	LLA	9/15/2010
Approved:	LLA	9/15/2010

PROJECT NUMBER 60157738

FIGURE NUMBER 5-1

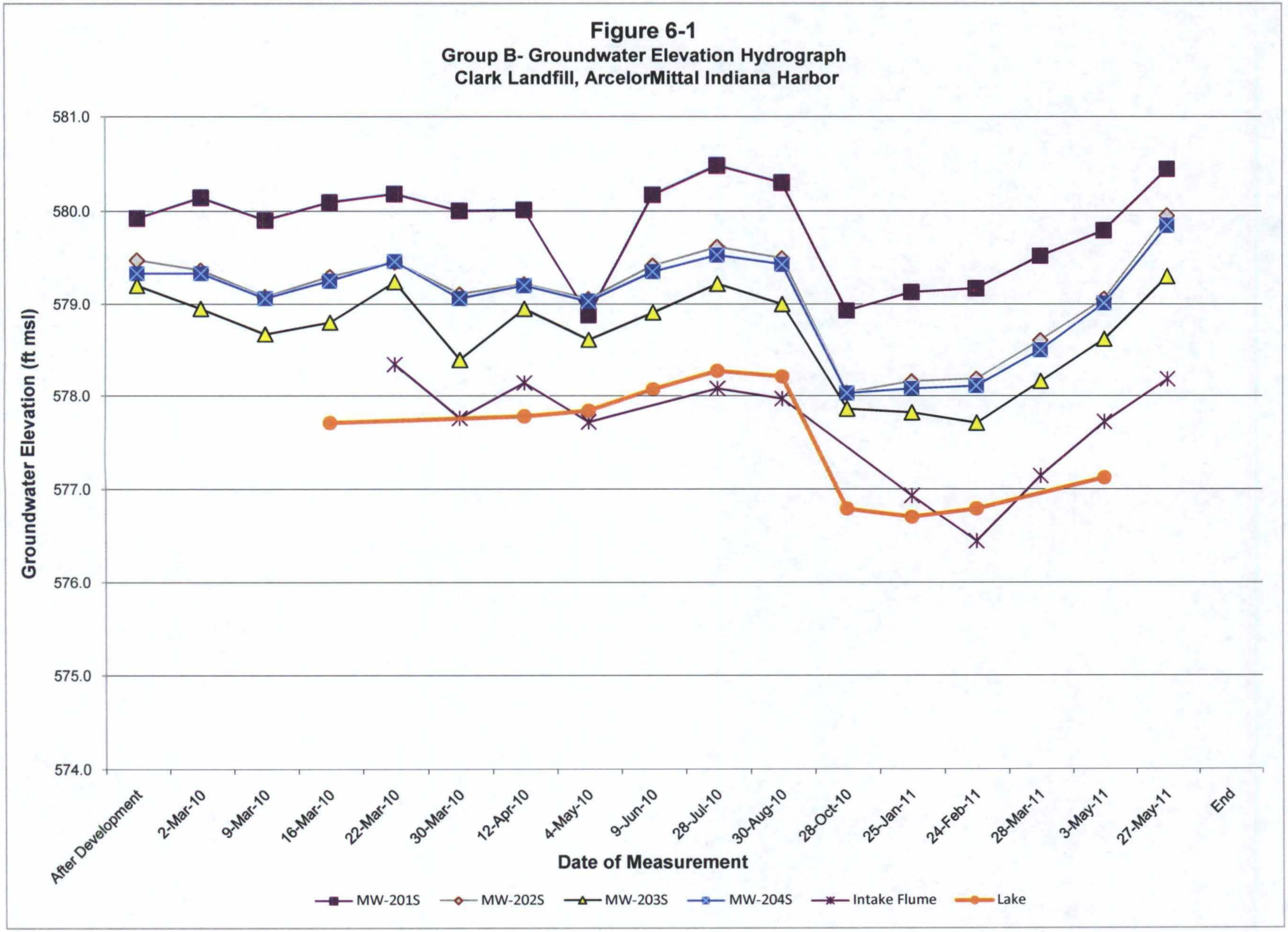
Figure 6-1
Group B- Groundwater Elevation Hydrograph
Clark Landfill, ArcelorMittal Indiana Harbor
Groundwater Elevation (ft msl)
581.0
580.0
579.0
578.0
577.0
576.0
575.0
574.0
After Development
2-Mar-10
9-Mar-10
16-Mar-10
22-Mar-10
30-Mar-10
12-Apr-10
4-May-10
9-Jun-10
28-Jul-10
30-Aug-10
28-Oct-10
25-Jan-11
24-Feb-11
28-Mar-11
3-May-11
27-May-11
End
Date of Measurement
MW-201S
MW-202S
MW-203S
MW-204S
Intake Flume
Lake

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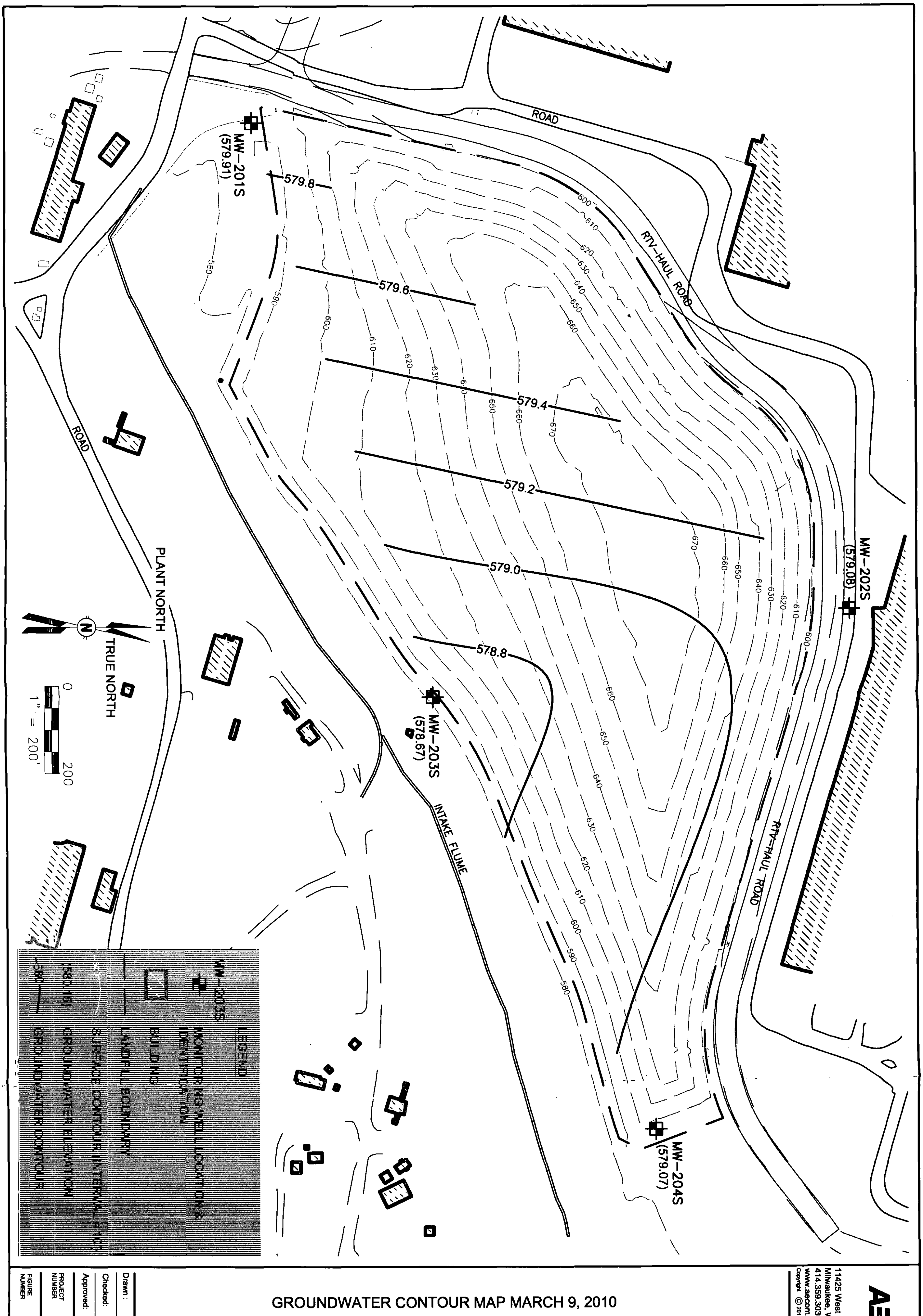

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GROUNDWATER CONTOUR MAP MARCH 9, 2010

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH	9/15/2010
Checked:	LLA	9/15/2010
Approved:	LLA	9/15/2010
PROJECT NUMBER	60157738	
FIGURE NUMBER	6-2	

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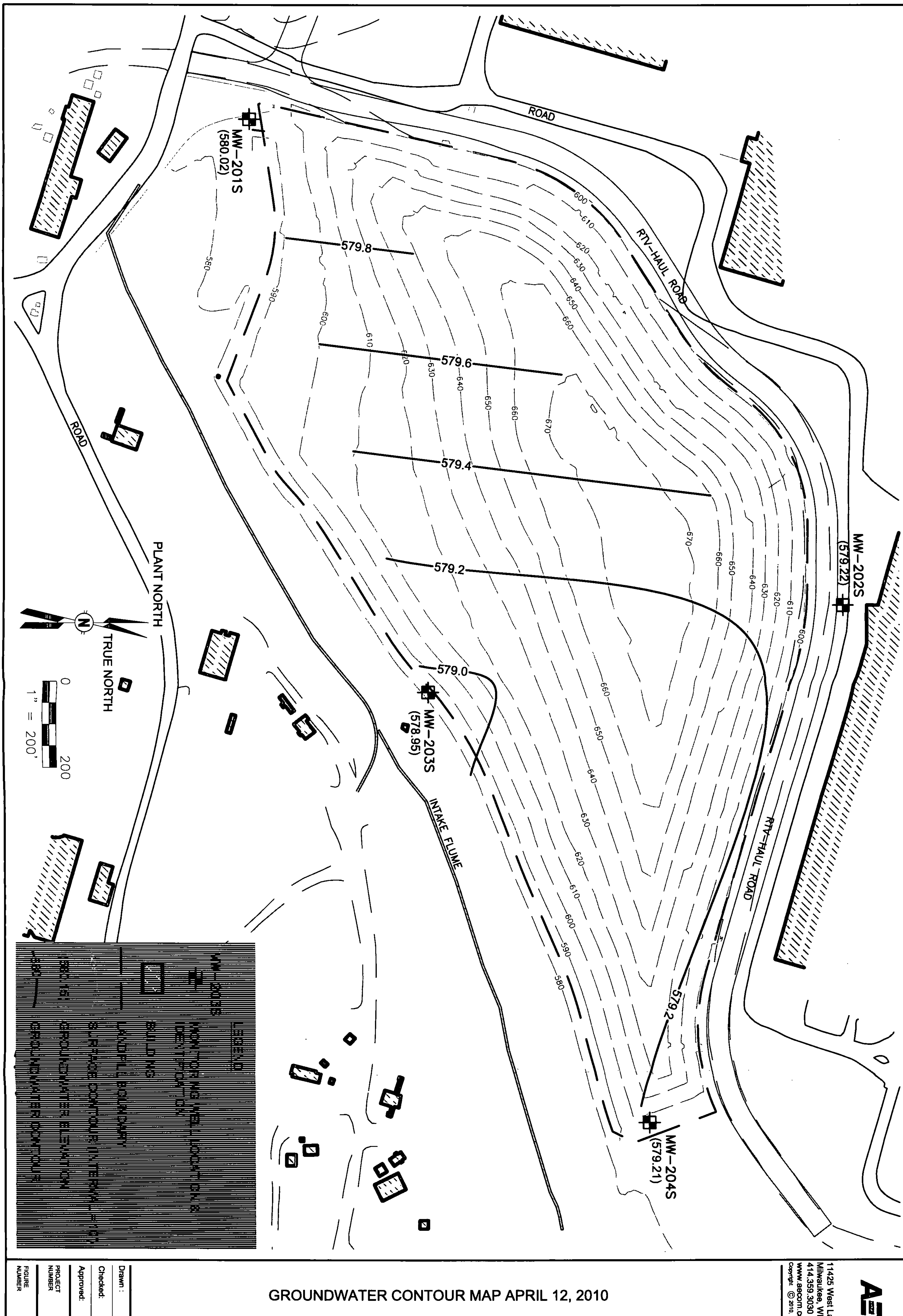

Drawn:	CJH 9/15/2010
Checked:	LLA 9/15/2010
Approved:	LLA 9/15/2010
PROJECT NUMBER	60157738
FIGURE NUMBER	6-3

GROUNDWATER CONTOUR MAP APRIL 12, 2010

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

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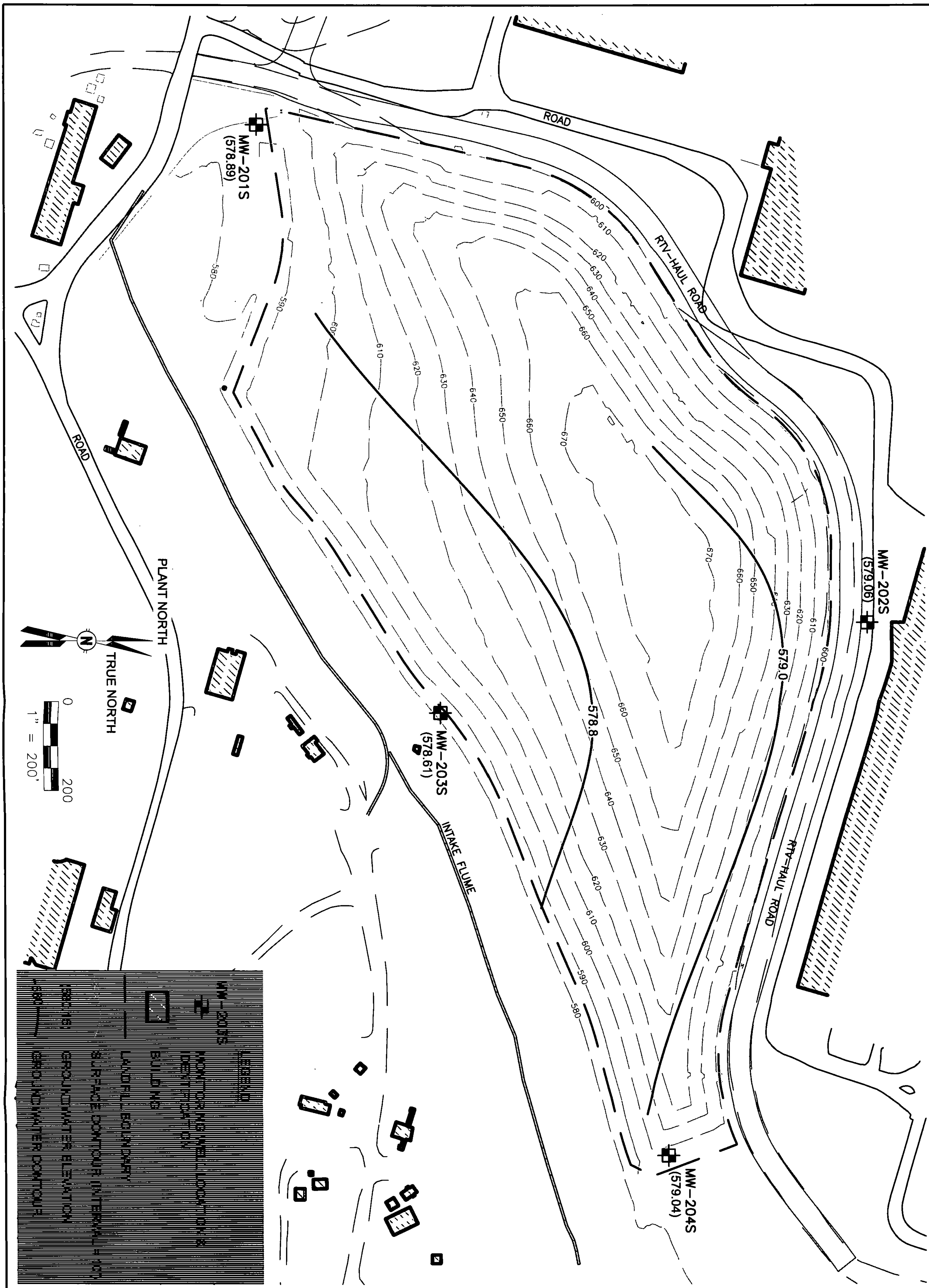

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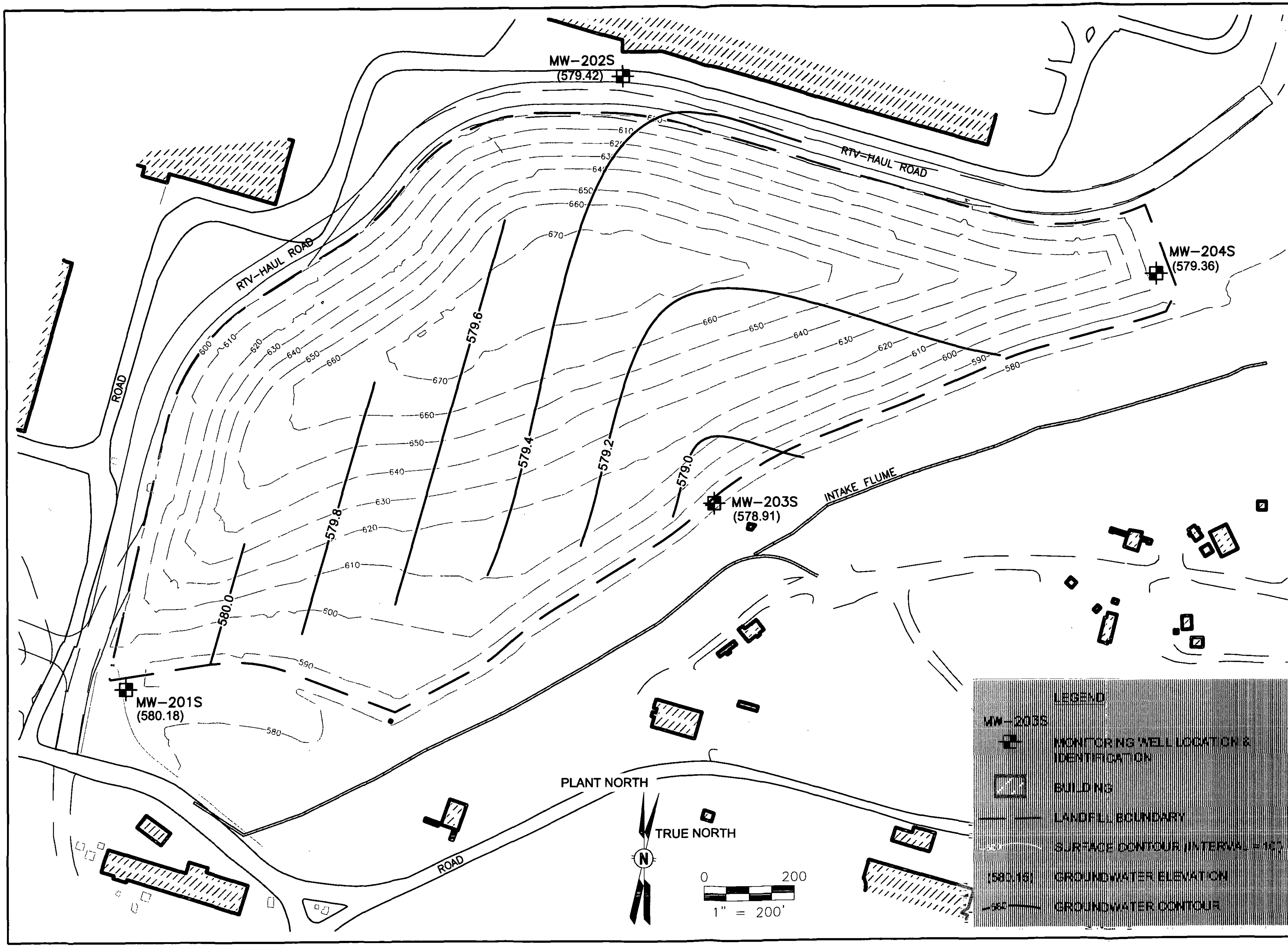
GROUNDWATER CONTOUR MAP MAY 4, 2010

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH	9/15/2010
Checked:	LLA	9/15/2010
Approved:	LLA	9/15/2010
PROJECT NUMBER	60157738	
FIGURE NUMBER	6-4	



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GROUNDWATER CONTOUR MAP JUNE 9, 2010

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH	9/15/2010
Checked:	LLA	9/15/2010
Approved:	LLA	9/15/2010
PROJECT NUMBER	60157738	
FIGURE NUMBER	6-5	

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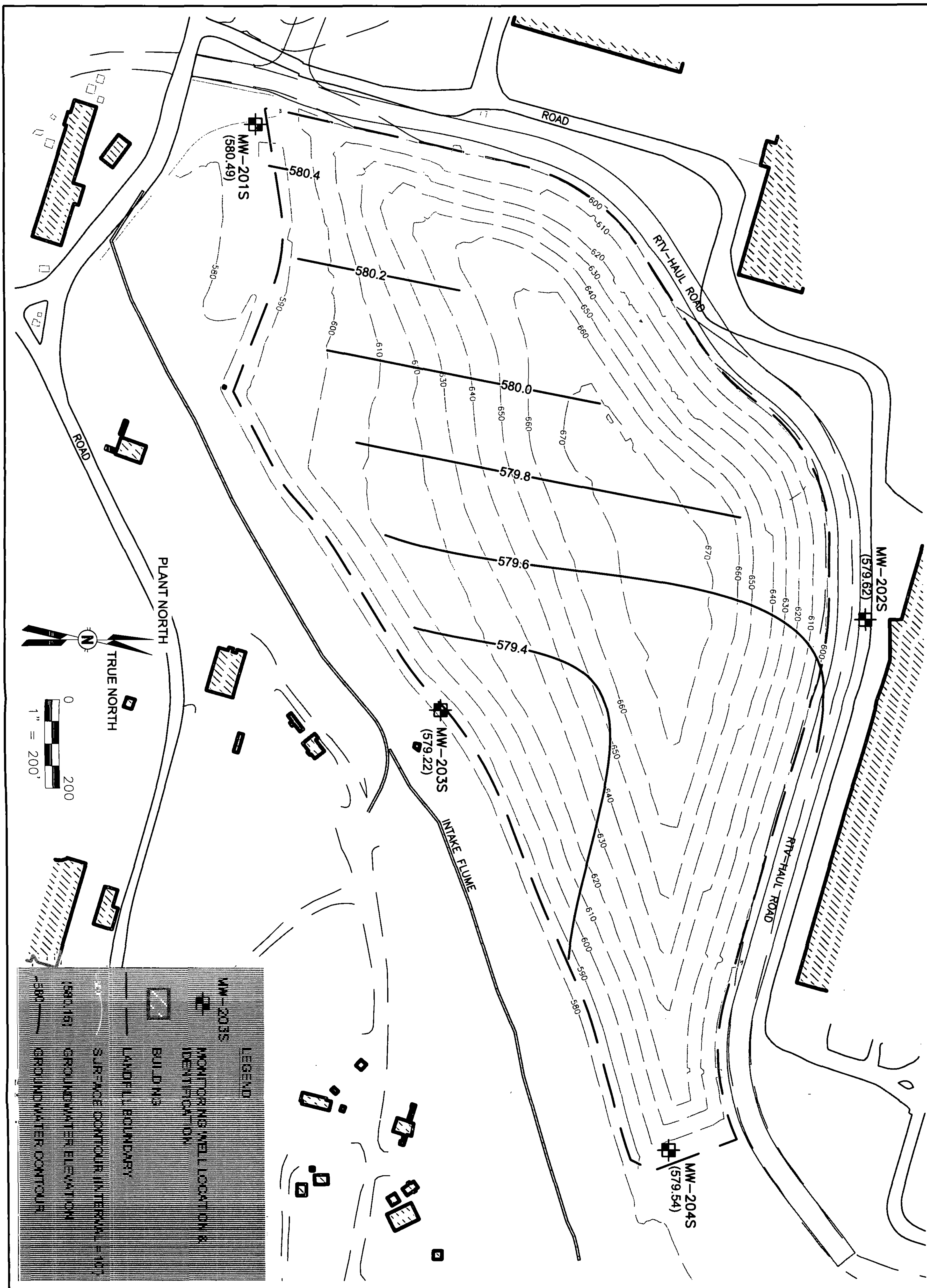

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GROUNDWATER CONTOUR MAP JULY 28, 2010

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH	9/15/2010
Checked:	LLA	9/15/2010
Approved:	LLA	9/15/2010
PROJECT NUMBER	60157738	
FIGURE NUMBER	6-6	

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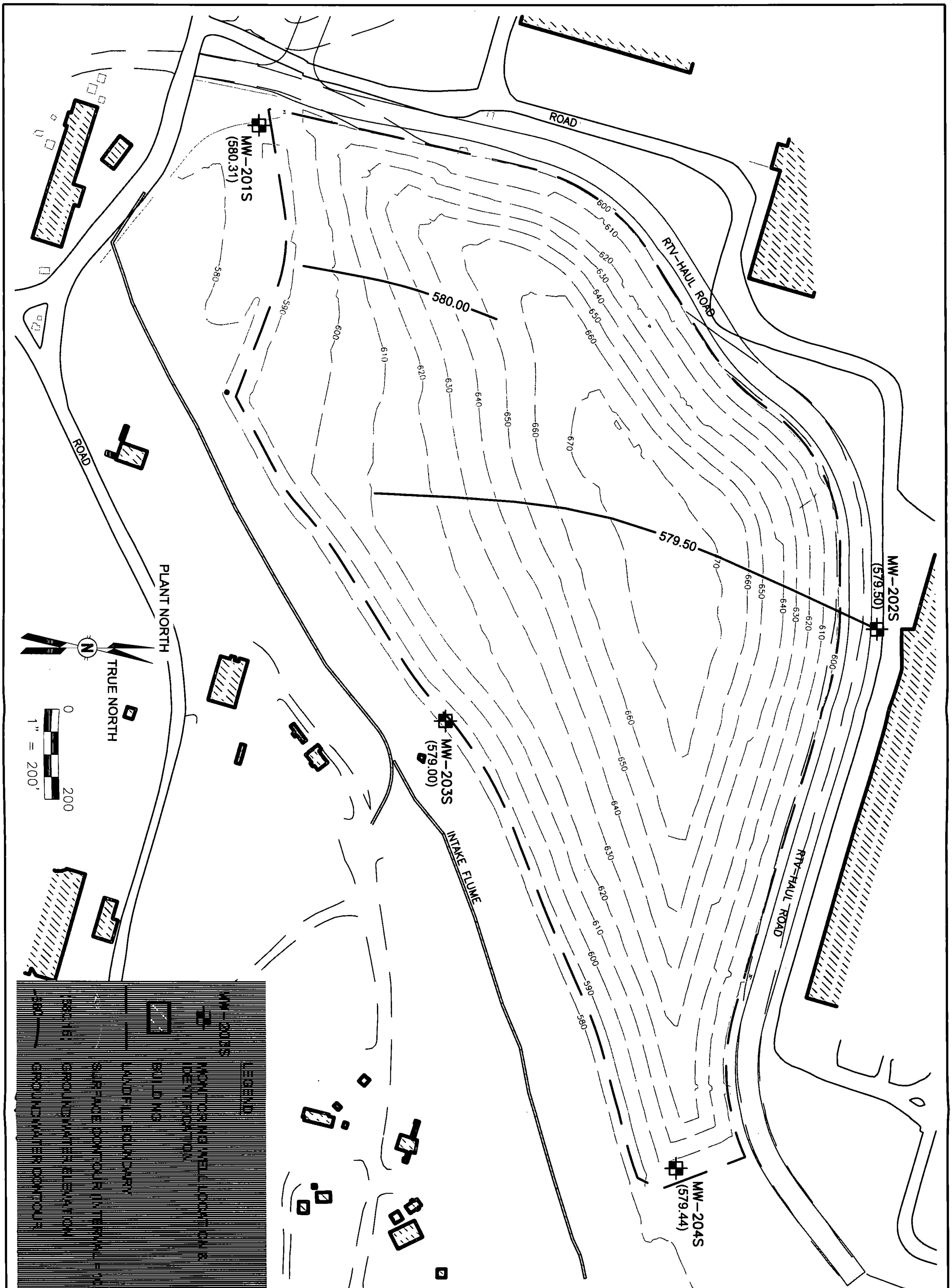

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GROUNDWATER CONTOUR MAP AUGUST 30, 2010

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH 9/15/2010
Checked:	LLA 9/15/2010
Approved:	LLA 9/15/2010
PROJECT NUMBER	60157738
FIGURE NUMBER	6-7

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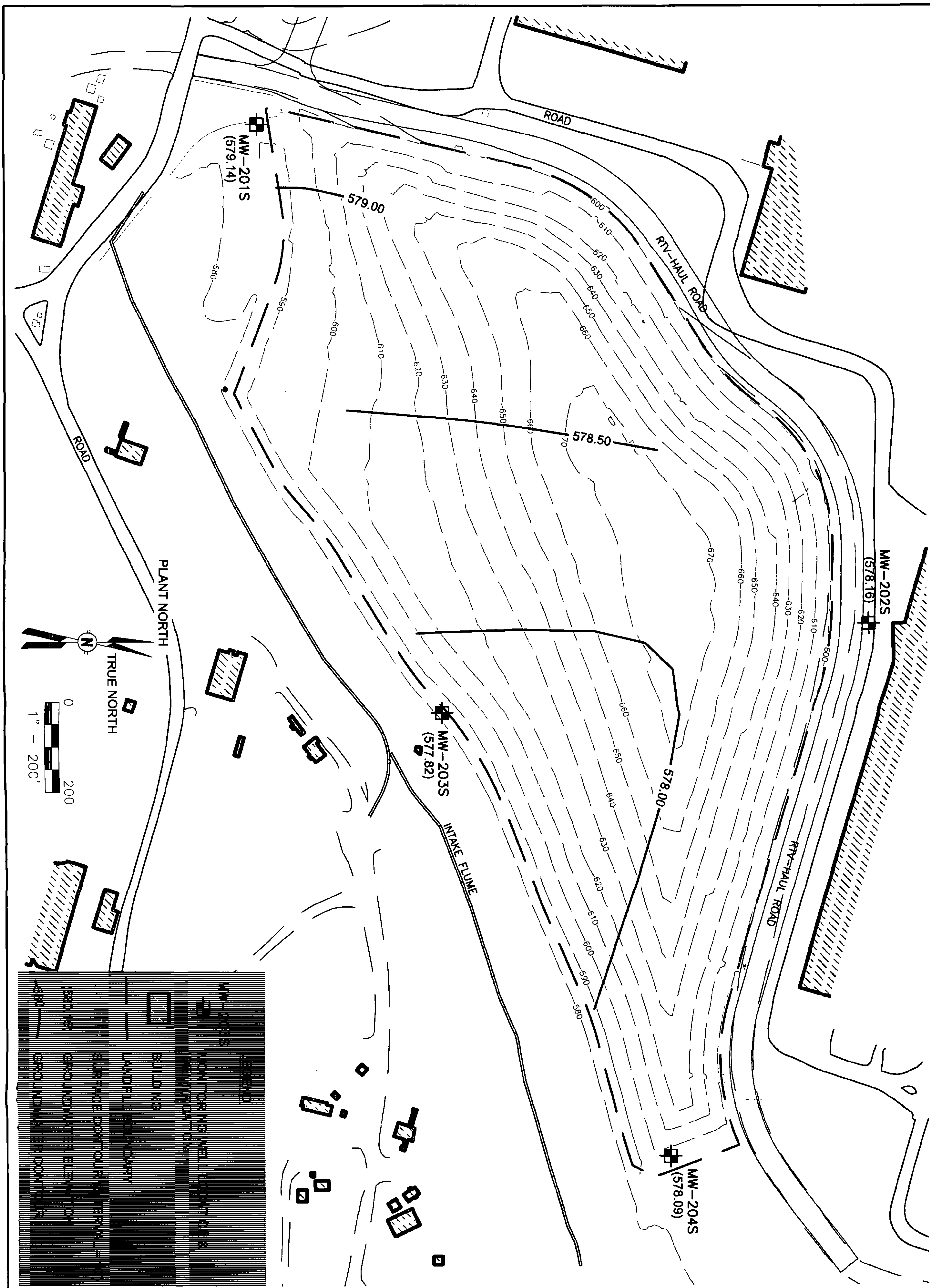

Drawn:	CJH 9/15/2010
Checked:	LLA 9/15/2010
Approved:	LLA 9/15/2010
PROJECT NUMBER	60157738
FIGURE NUMBER	6-8

GROUNDWATER CONTOUR MAP JANUARY 25, 2011

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

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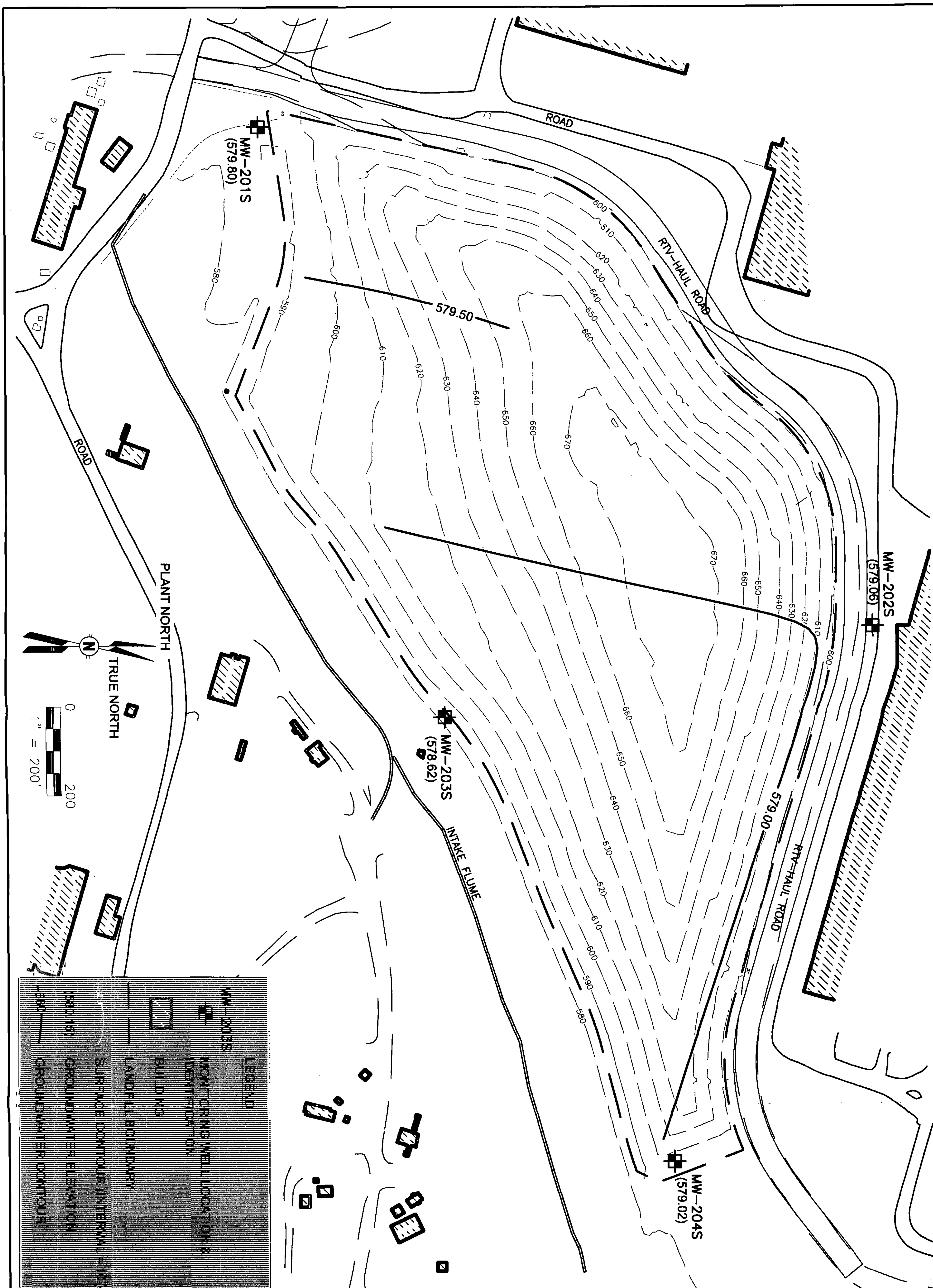

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GROUNDWATER CONTOUR MAP MAY 3, 2011

CLARK LANDFILL
ARCELORMITTAL INDIANA HARBOR LLC.(WEST)
EAST CHICAGO, INDIANA

Drawn:	CJH	9/15/2010
Checked:	LLA	9/15/2010
Approved:	LLA	9/15/2010
PROJECT NUMBER	60157738	
FIGURE NUMBER	6-9	

Appendix A

Slag-fill/soil Boring Logs and Monitoring Well Construction Diagrams

AECOM

OWNER: **ArcelorMittal Indiana Harbor LLC**	LOG OF BORING NUMBER: **MW-201S**
PROJECT NAME: **ArcelorMittal Indiana Harbor LLC (Clark Landfill)**	ARCHITECT-ENGINEER
SITE LOCATION: **3001 Dickey Road, East Chicago, IN**	

SURFACE ELEVATION (ft.) +598.2

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.²: 1 2 3 4 5
PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50
STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

DEPTH(FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.³	PID/FID	STANDARD PENETRATION BLOWS/FT.
			Blind Drill			
2.0	1	SS	Slag Fill: Sand to Gravel - brown - moist - medium dense to dense		0.0	22
5	2	SS			0.0	24
	3	SS	*Note: 1.5" layer of orange sand-sized slag at 7.4'*		0.0	35
8.0	4	SS	Slag Fill: Sand - light gray - dense		0.0	50/4"
10	5	SS			0.0	42
	6	SS			0.0	26
15	7	SS			0.0	30
16.5	8	SS	Slag Fill: Sand to Gravel - gray to black - wet - very dense		0.0	42
	9	SS	*Note: Wet at 19.5'*		0.0	67
20.0	10	SS	Slag Fill: black - slight sheen at 21' - faint odor			56
	11	SS				37
24.0 (25)			Blind Drilled to 28'			
28.0			End of Boring Boring advanced to 28.0 ft. by a hollow stem auger. Standard Penetration Tests performed with a 140 lb. hammer dropped 30 inches. Groundwater monitoring well installed at 27.0 ft. on 11/17/09. (See diagram for details.)	* Calibrated Penetrometer		

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED 11/17/09	STS OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL	BORING COMPLETED 11/17/09	ENTERED BY LJE	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /RDnP-Paul Eger	APP'D BY LLA	STS JOB NO. 60157738

ISG BORING LOG AECOM 60157738 CLARK LF ISG.GPJ STS.GDT 6/16/11

AECOM	OWNER: ArcelorMittal Indiana Harbor LLC	LOG OF BORING NUMBER: MW-202S
	PROJECT NAME: ArcelorMittal Indiana Harbor LLC (Clark Landfill)	ARCHITECT-ENGINEER

SITE LOCATION: 3001 Dickey Road, East Chicago, IN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

SURFACE ELEVATION (ft.) +601.0

DEPTH (FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	Standard Penetration Blows/Ft.
0.0–2.0			Blind Drill	
2.0–4.0	1	SS	Slag Fill: Sand size - black - very dense	50/5"
4.0–10.0	2	SS	Slag Fill: Sand to Gravel size - gray to greenish - very dense	39
	3	SS		50/5"
	4	SS		30
10.0–12.0	5	SS	Slag Fill: Sand to Gravel size - gray to greenish - moist - very dense	79
12.0–24.0	6	SS	Slag Fill: Sand to Fine Gravel size - black - very dense	64/10"
	7	SS		50/3"
	8	SS		50/4"
	9	SS		50/5"
	10	SS		50/4"
	11	SS		50/4"
24.0–31.0			Blind Drilled	
31.0			End of Boring	

* Calibrated Penetrometer

Boring advanced to 31.0 ft. by a hollow stem auger.
Standard Penetration Tests performed with a 140 lb. hammer dropped 30 inches.
Groundwater monitoring well installed at 30.0 ft. on 11/19/09.
(See diagram for details.)

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED 11/19/09	STS OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL	BORING COMPLETED 11/19/09	ENTERED BY LJE	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /RDnP-Paul Eger	APP'D BY LLA	STS JOB NO. 60157738

AECOM

OWNER	LOG OF BORING NUMBER
ArcelorMittal Indiana Harbor LLC	**MW-203S**
PROJECT NAME	ARCHITECT-ENGINEER
ArcelorMittal Indiana Harbor LLC (Clark Landfill)	

SITE LOCATION
3001 Dickey Road, East Chicago, IN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

SURFACE ELEVATION (ft.) +585.1

DEPTH(FT)	SAMPLE NO.	SAMPLE TYPE	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.^{3}	STANDARD PENETRATION BLOWS/FT.
0.0–12.0			Blind Drill through large limestone gravel placed for cap and as slope protection - no cuttings brought up by auger.		
12.0–14.0	1	SS	Slag Fill: Sand and Gravel - gray *Note: Little recovery in spoon*		19
14.0–18.0	2	SS	Slag Fill: Fine to Medium Sand size - black to gray - faint odor *Note: Little recovery in spoon*		2
	3	SS			7
18.0			End of Boring		

Boring advanced to 18.0 ft. by a hollow stem auger.
Standard Penetration Tests performed with a 140 lb. hammer dropped 30 inches.
Groundwater monitoring well installed at 15.0 ft. on 11/19/09.
(See diagram for details.)

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED 11/19/09	STS OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL	BORING COMPLETED 11/19/09	ENTERED BY LJE	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /RDnP-Paul Eger	APP'D BY LLA	STS JOB NO. 60157738

AECOM

OWNER	LOG OF BORING NUMBER
ArcelorMittal Indiana Harbor LLC	**MW-204S**
PROJECT NAME	ARCHITECT-ENGINEER
ArcelorMittal Indiana Harbor LLC (Clark Landfill)	

SITE LOCATION
3001 Dickey Road, East Chicago, IN

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.^{2}: 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT %: 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT.: 10 20 30 40 50

SURFACE ELEVATION (ft.) +597.3

DEPTH(FT)	ELEVATION(FT)	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL	Unit Dry Wt. LBS./FT.^{3}	PID/FID	STANDARD PENETRATION BLOWS/FT.
						Blind Drill			
2.0									
		1	SS			Slag Fill: Sand to Gravel size - brown - moist - dense to very dense		0.0	31
5		2	SS					0.0	35
		3	SS					0.0	31
		4	SS					0.0	61/8"
10		5	SS					0.0	28
		6	SS					0.0	24
15		7	SS						31
16.0									
		8	SS			Slag Fill: Sand to Gravel size - dark gray - wet - medium dense			18
		9	SS						21
20		10	SS			***Note: 1 or 2 larger slag chunks to small gravel size***			15
		11	SS						19
25		12	SS						13
26.0						End of Boring			

Boring advanced to 26.0 ft. by a hollow stem auger.
Standard Penetration Tests performed with a 140 lb. hammer dropped 30 inches.
Groundwater monitoring well installed at 25.0 ft. on 11/16/09. (See diagram for details.)

* Calibrated Penetrometer

The stratification lines represent the approximate boundary lines between soil types: in situ, the transition may be gradual.

WL	BORING STARTED 11/19/09	STS OFFICE	11425 West Lake Park Drive Milwaukee, WI 53224
WL	BORING COMPLETED 11/19/09	ENTERED BY LJE	SHEET NO. 1 OF 1
WL	RIG/FOREMAN /RDnP-Paul Eger	APP'D BY LLA	STS JOB NO. 60157738

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
rcelorMittal Indiana Harbor LLC (Clark Landfill)	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	MW-201S
AECOM	Grid Origin Location (Check if estimated: ☐) Lat. ___° ___' ___" Long. ___° ___' ___" or St. Plane ______ ft. N, ______ ft. E. S/C/N	
	Section Location ____1/4 of____ 1/4 of Sec.____, T.____N, R. ____ ☐ E ☐ W	Date Well Installed 11/17/2009
		Well Installed By: (Person's Name and Firm) Paul Eger RDnP

A. Protective pipe, top elevation 600.41 ft. MSL

B. Well casing, top elevation 600.47 ft. MSL

C. Land surface elevation 598.2 ft. MSL

D. Surface seal, bottom ______ ft. MSL or ______ ft.

12. USC classification of soil near screen:
GP ☐ GM☐ GC ☐ GW☐ SW☐ SP ☐
SM ☐ SC ☐ ML ☐ MH☐ CL ☐ CH ☐
Bedrock☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
______ Other ☐ _ _

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe______

17. Source of water (attach analysis):

______

E. Bentonite seal, top 598.2 ft. MSL or 0.0 ft.

F. Fine sand, top 585.1 ft. MSL or 13.1 ft.

G. Filter pack, top 583.1 ft. MSL or 15.1 ft.

H. Screen joint, top 581.2 ft. MSL or 17.0 ft.

I. Well bottom 571.2 ft. MSL or 27.0 ft.

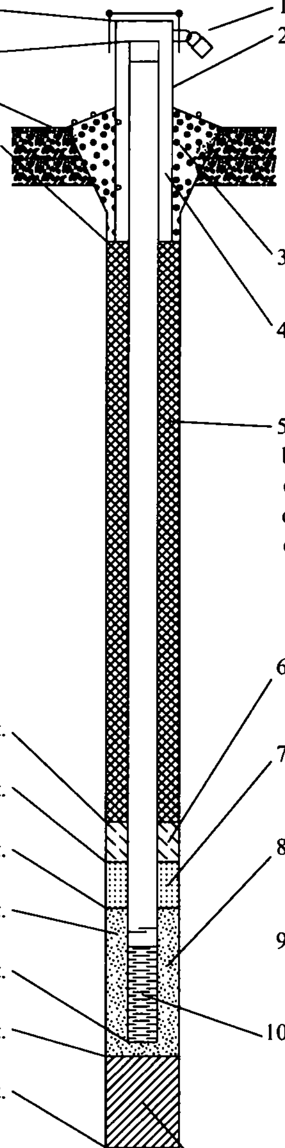
J. Filter pack, bottom 570.2 ft. MSL or 28.0 ft.

K. Borehole, bottom 570.2 ft. MSL or 28.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.0 in.

N. I.D. well casing 1.9 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ 0 4
   ______ Other ☐ _ _
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bumper Posts
3. Surface seal: Bentonite ☒ 3 0
   Concrete ☐ 0 1
   ______ Other ☐ _ _
4. Material between well casing and protective pipe:
   Bentonite ☐ 3 0
   None Other ☒ _ _
5. Annular space seal: a. Chipped Bentonite ☒ 3 3
   b. ____Lbs/gal mud weight . Bentonite-sand slurry ☐ 3 5
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
   d. ____% Bentonite . . . Bentonite-cement grout ☐ 5 0
   e. ______Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ 0 1
   Tremie pumped ☐ 0 2
   Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☐ 3 3
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☒ 3 2
   c.______ Other ☐ _ _
7. Fine sand material: Manufacturer, product name and mesh size
   a. Global No. 7 Sand _ _
   b. Volume added______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
   a. Global No. 5 Sand _ _
   b. Volume added______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
   Flush threaded PVC schedule 80 ☐ 2 4
   ______ Other ☐ _ _
10. Screen material: Schedule 40 PVC _ _
    a. Screen Type: Factory cut ☒ 1 1
    Continuous slot ☐ 0 1
    ______ Other ☐ _ _
    b. Manufacturer ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
    ______ Other ☐ _ _

x

Signature

Firm AECOM
11425 West Lake Park Drive, Milwaukee, WI 53224

Tel: 414-359-3030
Fax: 414-359-0822

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
rcelorMittal Indiana Harbor LLC (Clark Landfill)	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	MW-202S
AECOM	Grid Origin Location (Check if estimated: ☐) Lat. ___ ° ___ ' ___ " Long. ___ ° ___ ' ___ " or St. Plane ______ ft. N, ______ ft. E. S / C / N	
	Section Location ___ 1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐ E ☐ W	Date Well Installed 11/19/2009
		Well Installed By: (Person's Name and Firm) Paul Eger RDnP

A. Protective pipe, top elevation 603.48 ft. MSL

B. Well casing, top elevation 603.53 ft. MSL

C. Land surface elevation 601.0 ft. MSL

D. Surface seal, bottom ______ ft. MSL or ______ ft.

12. USC classification of soil near screen:
GP ☐ GM☐ GC ☐ GW☐ SW☐ SP ☐
SM ☐ SC ☐ ML ☐ MH☐ CL ☐ CH ☐
Bedrock☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
______ Other ☐ _ _

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe______

17. Source of water (attach analysis):

______

E. Bentonite seal, top 601.0 ft. MSL or 0.0 ft.

F. Fine sand, top 585.0 ft. MSL or 16.0 ft.

G. Filter pack, top 583.0 ft. MSL or 18.0 ft.

H. Screen joint, top 581.0 ft. MSL or 20.0 ft.

I. Well bottom 571.0 ft. MSL or 30.0 ft.

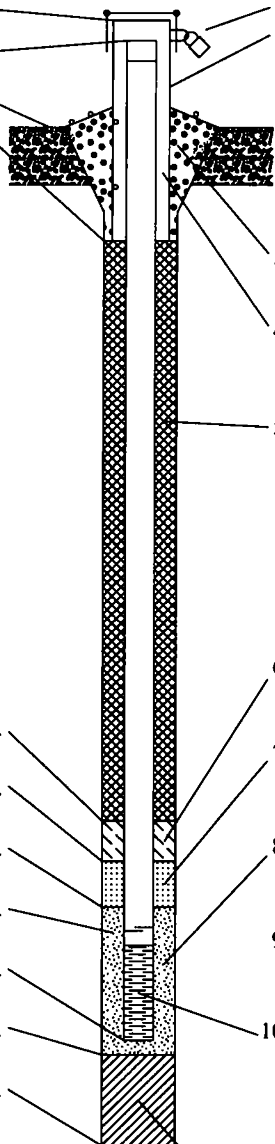
J. Filter pack, bottom 570.0 ft. MSL or 31.0 ft.

K. Borehole, bottom 570.0 ft. MSL or 31.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.0 in.

N. I.D. well casing 1.9 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ 0 4
      ______ Other ☐ _ _
   d. Additional protection? ☐ Yes ☒ No
      If yes, describe:______
3. Surface seal: Bentonite ☒ 3 0
   Concrete ☐ 0 1
   ______ Other ☐ _ _
4. Material between well casing and protective pipe:
   Bentonite ☐ 3 0
   None Other ☒ _ _
5. Annular space seal: a. Chipped Bentonite ☒ 3 3
   b. ____Lbs/gal mud weight . Bentonite-sand slurry ☐ 3 5
   c. ____Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
   d. ____% Bentonite . . . Bentonite-cement grout ☐ 5 0
   e. ______Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ 0 1
      Tremie pumped ☐ 0 2
      Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☐ 3 3
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☒ 3 2
   c.______ Other ☐ _ _
7. Fine sand material: Manufacturer, product name and mesh size
   a. Global No. 7 Sand _ _
   b. Volume added______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
   a. Global No. 5 Sand _ _
   b. Volume added______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
   Flush threaded PVC schedule 80 ☐ 2 4
   ______ Other ☐ _ _
10. Screen material: Schedule 40 PVC _ _
    a. Screen Type: Factory cut ☒ 1 1
       Continuous slot ☐ 0 1
       ______ Other ☐ _ _
    b. Manufacturer______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
    ______ Other ☐ _ _

x

Signature	Firm AECOM 11425 West Lake Park Drive, Milwaukee, WI 53224	Tel: 414-359-3030 Fax: 414-359-0822

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
·celorMittal Indiana Harbor LLC (Clark Landfill)	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	MW-203S
AECOM	Grid Origin Location (Check if estimated: ☐) Lat. ___° ___' ___" Long. ___° ___' ___" or	
	St. Plane ______ ft. N, ______ ft. E. S/C/N	Date Well Installed 11/19/2009
	Section Location ___ 1/4 of ___ 1/4 of Sec. ___, T. ___ N, R. ___ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Paul Eger RDnP

A. Protective pipe, top elevation 587.86 ft. MSL

B. Well casing, top elevation 587.84 ft. MSL

C. Land surface elevation 585.1 ft. MSL

D. Surface seal, bottom ______ ft. MSL or ______ ft.

12. USC classification of soil near screen:
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☒
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐
Bedrock ☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
______ Other ☐ __

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe ______

17. Source of water (attach analysis):

______

E. Bentonite seal, top 585.1 ft. MSL or 0.0 ft.

F. Fine sand, top 582.1 ft. MSL or 3.0 ft.

G. Filter pack, top 580.1 ft. MSL or 5.0 ft.

H. Screen joint, top 580.1 ft. MSL or 5.0 ft.

I. Well bottom 570.1 ft. MSL or 15.0 ft.

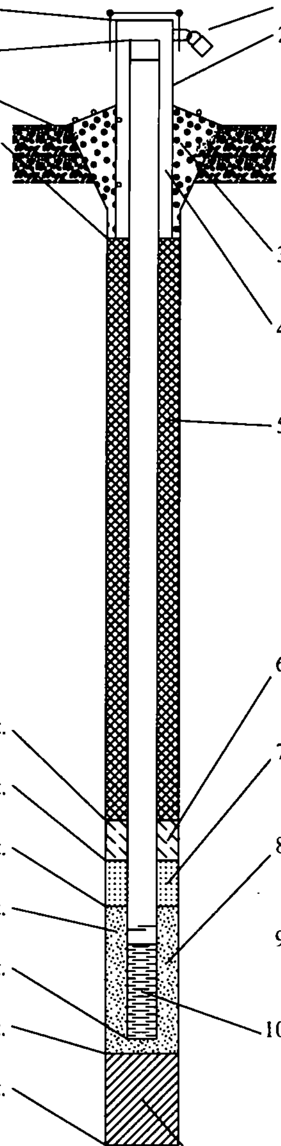
J. Filter pack, bottom 567.1 ft. MSL or 18.0 ft.

K. Borehole, bottom 567.1 ft. MSL or 18.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.0 in.

N. I.D. well casing 1.9 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ 0 4
   ______ Other ☐ __
   d. Additional protection? ☐ Yes ☒ No
   If yes, describe: ______
3. Surface seal: Bentonite ☐ 3 0
   Concrete ☐ 0 1
   Riprap Other ☒ __
4. Material between well casing and protective pipe:
   Bentonite ☒ 3 0
   ______ Other ☐ __
5. Annular space seal: a. Chipped Bentonite ☒ 3 3
   b. ___ Lbs/gal mud weight . Bentonite-sand slurry ☐ 3 5
   c. ___ Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
   d. ___ % Bentonite . . . Bentonite-cement grout ☐ 5 0
   e. ______ Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ 0 1
   Tremie pumped ☐ 0 2
   Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☐ 3 3
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☒ 3 2
   c. ______ Other ☐ __
7. Fine sand material: Manufacturer, product name and mesh size
   a. Global No. 7 Sand __
   b. Volume added ______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
   a. Global No. 5 Sand __
   b. Volume added ______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3
   Flush threaded PVC schedule 80 ☐ 2 4
   ______ Other ☐ __
10. Screen material: Schedule 40 PVC __
    a. Screen Type: Factory cut ☒ 1 1
    Continuous slot ☐ 0 1
    ______ Other ☐ __
    b. Manufacturer ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4
    ______ Other ☐ __

x

Signature	Firm AECOM 11425 West Lake Park Drive, Milwaukee, WI 53224	Tel: 414-359-3030 Fax: 414-359-0822

MONITORING WELL CONSTRUCTION

Facility/Project Name	Local Grid Location of Well	Well Name
rcelorMittal Indiana Harbor LLC (Clark Landfill)	______ ft. ☐ N. ☐ S. ______ ft. ☐ E. ☐ W.	MW-204S
	Grid Origin Location (Check if estimated: ☐) Lat. ___° ___' ___" Long. ___° ___' ___" or	
AECOM	St. Plane ______ ft. N, ______ ft. E. S/C/N	Date Well Installed 11/16/2009
	Section Location ___1/4 of___ 1/4 of Sec.___, T.___N, R.___ ☐ E ☐ W	Well Installed By: (Person's Name and Firm) Paul Eger RDnP

A. Protective pipe, top elevation 599.82 ft. MSL

B. Well casing, top elevation 599.91 ft. MSL

C. Land surface elevation 597.3 ft. MSL

D. Surface seal, bottom ______ ft. MSL or ______ ft.

12. USC classification of soil near screen:
GP ☒ GM☐ GC ☐ GW☐ SW☐ SP ☐
SM ☐ SC ☐ ML ☐ MH☐ CL ☐ CH ☐
Bedrock☐

13. Sieve analysis attached? ☐ Yes ☒ No

14. Drilling method used: Rotary ☐ 5 0
Hollow Stem Auger ☒ 4 1
Other ☐

15. Drilling fluid used: Water ☐ 0 2 Air ☐ 0 1
Drilling Mud ☐ 0 3 None ☒ 9 9

16. Drilling additives used? ☐ Yes ☒ No

Describe______

17. Source of water (attach analysis):

E. Bentonite seal, top 597.3 ft. MSL or 0.0 ft.

F. Fine sand, top 586.0 ft. MSL or 11.3 ft.

G. Filter pack, top 584.3 ft. MSL or 13.0 ft.

H. Screen joint, top 582.3 ft. MSL or 15.0 ft.

I. Well bottom 572.3 ft. MSL or 25.0 ft.

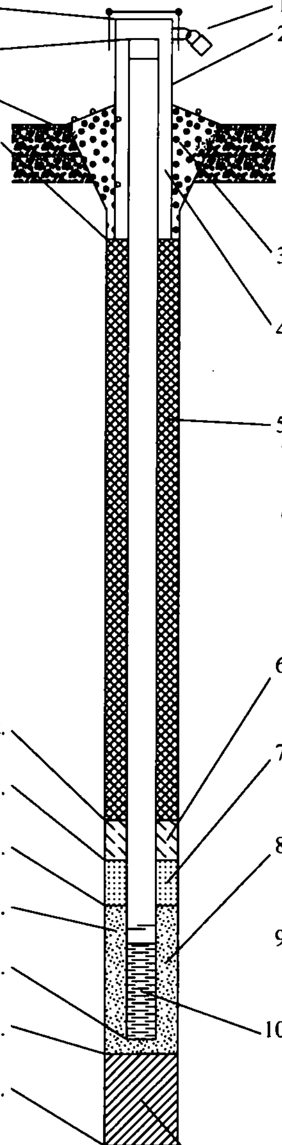
J. Filter pack, bottom 571.3 ft. MSL or 26.0 ft.

K. Borehole, bottom 571.3 ft. MSL or 26.0 ft.

L. Borehole, diameter 8.0 in.

M. O.D. well casing 2.0 in.

N. I.D. well casing 1.9 in.



1. Cap and lock? ☒ Yes ☐ No
2. Protective cover pipe:
   a. Inside diameter: 4.0 in.
   b. Length: 5.0 ft.
   c. Material: Steel ☒ 0 4; Other ☐
   d. Additional protection? ☒ Yes ☐ No
   If yes, describe: Bumper Posts
3. Surface seal: Bentonite ☒ 3 0; Concrete ☐ 0 1; Other ☐
4. Material between well casing and protective pipe: Bentonite ☐ 3 0; None Other ☒
5. Annular space seal: a. Chipped Bentonite ☒ 3 3
   b. ___Lbs/gal mud weight . Bentonite-sand slurry ☐ 3 5
   c. ___Lbs/gal mud weight . . . Bentonite slurry ☐ 3 1
   d. ___% Bentonite . . . Bentonite-cement grout ☐ 5 0
   e. ______Ft^3 volume added for any of the above
   f. How installed: Tremie ☐ 0 1; Tremie pumped ☐ 0 2; Gravity ☒ 0 8
6. Bentonite seal: a. Bentonite granules ☐ 3 3
   b. ☐ 1/4 in. ☒ 3/8 in. ☐ 1/2 in. Bentonite pellets ☒ 3 2
   c.______ Other ☐
7. Fine sand material: Manufacturer, product name and mesh size
   a. Global No. 7 Sand
   b. Volume added______ ft^3
8. Filter pack material: Manufacturer, product name and mesh size
   a. Global No. 5 Sand
   b. Volume added______ ft^3
9. Well casing: Flush threaded PVC schedule 40 ☒ 2 3; Flush threaded PVC schedule 80 ☐ 2 4; Other ☐
10. Screen material: Schedule 40 PVC
    a. Screen Type: Factory cut ☒ 1 1; Continuous slot ☐ 0 1; Other ☐
    b. Manufacturer ______
    c. Slot size: 0.010 in.
    d. Slotted length: 10.0 ft.
11. Backfill material (below filter pack): None ☒ 1 4; Other ☐

x

Signature	Firm AECOM 11425 West Lake Park Drive, Milwaukee, WI 53224	Tel: 414-359-3030 Fax: 414-359-0822

Appendix B

Well Development Field Data

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: Clark Landfill   Well ID Number: MW-20D S

Date of Completion: 11/20 & 24 /09   STS Job Number:

Start Time: 13:30 11/20   End Time: 14:30 11/20
13:30 11/24   14:55 11/24

Water color at start of development: black   Water color at end of development: clear

Amount of water removed during development: 20 gallons 11/20
pumped 48 gallons 11/24

Contained water? [X] Yes [ ] No

If not contained, where water disposed?

Well Development Methods:
- [X] Surged with bailer and bailed
- [ ] Surged with block and bailed
- [ ] Surged with block, bailed & pumped
- [ ] Bailed only
- [X] Pumped slowly
- [ ] Surged with bailer and pumped
- [ ] Surged with block and pumped
- [ ] Compressed Air
- [ ] Pumped only
- [ ] Other

Equipment Used
- [X] PVC bailer
- [ ] Well wizard
- [ ] Bean or Moino pump (on drill rig)
- [ ] Surge block
- [X] Whale pumps

Notes: pump failed, came back on 11/24

WELL DEVELOPMENT FIELD RECORD

Job Name Clark Landfill Job No. ______ Well No. MW-201 S

Developed By Josh Rowe Date of Install. ~~[illegible]~~ 11/17/09 Sheet ____ of ____

Started Devel. 11/20/09 / 13:30 ; 11/24/09 13:30 (DATE / TIME) Completed Devel. 11/20/09 / 14:30 ; 11/24/09 14:55 (DATE / TIME)

W.L. Before Devel. 11/20/09 / 13:30 / 20.50 ; 11/24/09 13:30 20.50 (DATE / TIME / DEPTH) After Devel. 11/20/09 / 14:30 / 20.50 ; 11/24/09 14:55 20.48 (DATE / TIME / DEPTH)

Well Depth: Before Devel. 27' After Devel. ______ Well Dia. (in.) 2

Standing Water Column (ft.) ______ Standing Well Volume ______ gal.

Screen Length 10' Drilling Water Loss ______ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
11/24/09 14:38		.475	19.7	9.87	340	-253	
14:41		.464	19.9	9.87	57	-261	
14:44		.459	20.0	9.77	17	-258	
14:46		.456	20.0	9.73	11	-260	
14:49		.454	20.0	9.70	8	-261	
14:52		.453	20.0	9.69	7	-261	
14:55	48	.453	20.0	9.69	6	-261	
11/20/09 14:30	20						
	68	= TOTAL VOLUME REMOVED (Gallons)					

Development Method: ______

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: Clark Landfill Well ID Number: MW-202S

Date of Completion: 11/20 & 24/09 STS Job Number: ____

Start Time: 10:00 11/20 10:15 11/24 End Time: 11:35 11/20

Water color at start of development: blackish gray Water color at end of development: clear

Amount of water removed during development: bailed 10 gallons 11/20 pumped 48 gallons 11/24

Contained water? [X] Yes [ ] No

If not contained, where water disposed? ____

Well Development Methods:

- [X] Surged with bailer and bailed
- [ ] Surged with block and bailed
- [ ] Surged with block, bailed & pumped
- [ ] Bailed only
- [X] Pumped slowly
- [ ] Surged with bailer and pumped
- [ ] Surged with block and pumped
- [ ] Compressed Air
- [ ] Pumped only
- [ ] Other ____

Equipment Used

- [X] PVC bailer
- [ ] Well wizard
- [ ] Bean or Moino pump (on drill rig)
- [ ] Surge block
- [X] Whale pumps

Notes: pump failed, came back on 11/24

WELL DEVELOPMENT FIELD RECORD

Job Name Clark Landfill   Job No. ______   Well No. MW-202S

Developed By Josh Rowe   Date of Install. ~~[illegible]~~ 11/19/09   Sheet ____ of ____

Started Devel. 11/20/09 / 10:00 (DATE / TIME)
11/24/09 10:15

Completed Devel. 11/20/09 / 11:35 (DATE / TIME)
11/24/09 11:50

W.L. Before Devel. 11/20/09 / 10:00 / 24.07 (DATE / TIME / DEPTH)
11/24/09 10:15 24.00

After Devel. 11/20/09 / 11:35 / 24.00 (DATE / TIME / DEPTH)
11/24/09 11:50 24.00

Well Depth: Before Devel. 30'   After Devel. ______   Well Dia. (in.) 2

Standing Water Column (ft.) ______   Standing Well Volume ______ gal.

Screen Length 10'   Drilling Water Loss ______ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
11/24/09 11:13		2.99	17.7	11.9	—	-201	
11:16		2.99	17.9	11.59	—	-264	
11:19		3.01	18.0	11.52	60	-270	
11:21		3.00	18.1	11.52	47	-245	
11:24		2.98	18.1	11.51	10	-257	
11:27		2.98	18.1	11.51	9	-260	
11:30	48	2.98	18.1	11.51	8	-262	
11/20/09 11:35	10						
	58	= TOTAL VOLUME REMOVED (Gallons)					

Development Method: ______

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: Clark Landfill Well ID Number: MW-203S

Date of Completion: 11/20&24/09 STS Job Number:

Start Time: 12:20 11/20 End Time: 13:16 11/20
11:55 11/24 12:52 11/24

Water color at start of development: blackish gray Water color at end of development: clear

Amount of water removed during development: bailed 20 gallons 11/20
pumped 44 gallons 11/24

Contained water? [X] Yes [ ] No

If not contained, where water disposed?

Well Development Methods:

- [X] Surged with bailer and bailed
- [ ] Surged with block and bailed
- [ ] Surged with block, bailed & pumped
- [ ] Bailed only
- [X] Pumped slowly
- [ ] Surged with bailer and pumped
- [ ] Surged with block and pumped
- [ ] Compressed Air
- [ ] Pumped only
- [ ] Other

Equipment Used

- [X] PVC bailer
- [ ] Well wizard
- [ ] Bean or Moino pump (on drill rig)
- [ ] Surge block
- [X] Whale pumps

Notes: pump failed, came back on 11/24

WELL DEVELOPMENT FIELD RECORD

Job Name Clark Landfill Job No. Well No. MW-203 S

Developed By Josh Rove Date of Install. 11/19/09 Sheet of

Started Devel. 11/20/09 / 12:20 (DATE / TIME)
11/24/09 11:55
Completed Devel. 11/20/09 / 13:16 (DATE / TIME)
11/24/09 12:52

W.L. Before Devel. 11/20/09 / 12:20 / 8.70 (DATE / TIME / DEPTH)
11/24/09 11:55 8.65
After Devel. 11/20/09 / 13:16 / 8.66 (DATE / TIME / DEPTH)
11/24/09 12:32 8.55

Well Depth: Before Devel. 15' After Devel. 15' Well Dia. (In.) 2

Standing Water Column (ft.) Standing Well Volume gal.

Screen Length 10 ft Drilling Water Loss gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	REMARKS ORP	
11/20/09 13:15	20	1.92	18.9	12.27	66	-269	
11/24/09 12:35		2.02	20.1	11.16	76	-306	
12:38		2.53	20.3	11.44	15	-316	
12:41		2.52	20.4	11.43	6	-320	
12:43		2.52	20.4	11.43	5	-323	
12:46	44	2.52	20.4	11.42	4	-326	
	64	= TOTAL VOLUME REMOVED (Gallons)					

Development Method:

Notes:

Well Development Record

STS Consultants, Ltd.
11425 West Lake Park Drive
Milwaukee, Wisconsin 53224

Site Name: Clark Landfill Well ID Number: MW-204 S

Date of Completion: 11/20/09 STS Job Number: ______

Start Time: ~~9:00~~ 8:45 End Time: 9:25

Water color at start of development: gray Water color at end of development: clear

Amount of water removed during development: 21 gallons

Contained water? [X] Yes [ ] No

If not contained, where water disposed? ______

Well Development Methods:
- [X] Surged with bailer and bailed
- [ ] Surged with bailer and pumped
- [ ] Surged with block and bailed
- [ ] Surged with block and pumped
- [ ] Surged with block, bailed & pumped
- [ ] Compressed Air
- [ ] Bailed only
- [ ] Pumped only
- [X] Pumped slowly
- [ ] Other ______

Equipment Used
- [ ] PVC bailer
- [ ] Surge block
- [ ] Well wizard
- [X] Whale pumps
- [ ] Bean or Moino pump (on drill rig)

Notes: ______

WELL DEVELOPMENT FIELD RECORD

Job Name: Clark Landfill　　Job No. ______　　Well No. MW-204S

Developed By: Josh Rowe　　Date of Install. 11/16/09　　Sheet ____ of ____

Started Devel. 11/20/09 (DATE) / 8:45 (TIME)　　Completed Devel. 11/20/09 (DATE) / 9:25 (TIME)

W.L. Before Devel. 11/20/09 (DATE) / 8:45 (TIME) / 20.40 (DEPTH)　　After Devel. 11/20/09 (DATE) / 9:25 (TIME) / 20.40 (DEPTH)

Well Depth: Before Devel. 30'　　After Devel. ______　　Well Dia. (In.) 2

Standing Water Column (ft.) ______　　Standing Well Volume ______ gal.

Screen Length 10'　　Drilling Water Loss ______ gal.

DATE / TIME	VOLUME REMOVED (Gallons)	FIELD PARAMETERS SPEC. COND. (umhos/cm)	TEMP. (C°)	pH (s.u.)	TURB ~~Other~~	ORP	REMARKS
11/20/09 9:25		1.58	16.9	10.86	180	-259	
9:28		1.65	17.4	11.31	30	-284	
9:33		1.65	17.7	11.94	13	-311	
9:36		1.65	17.9	12.07	10	-312	
9:39		1.66	17.9	12.13	6	-308	
9:42		1.66	17.9	12.16	5	-318	
9:45	21	1.66	18.0	12.15	4	-328	
	21	= TOTAL VOLUME REMOVED (Gallons)					

Development Method: ______

Notes:

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

Project Name: Clark Landfill Project No. ______

Location: ______ Tester: ______

Well Number: MW-203S Date Sampled: 11/20/09

Previous Well Sampled: WL pre-purge 20.50 @ 13:30

AECOM 11/24 20.50@13:

GENERAL CONDITIONS: If Missing Replaced?

Surface Seal:	☐	Ok	☐	Damaged	☐	Missing:	Yes	No
Protector Pipe:	☐	Ok	☐	Damaged	☐	Missing:	Yes	No
Well Cap:	☐	Ok	☐	Damaged	☐	Missing:	Yes	No
Ambient Temperature:	___	°F	☐	Clear	☐ Cloudy	☐	Rain	

WELL DATA:

Measuring Device: ______

Stick Up or Down: 11/20 11/24 (from Ground Surface)

WL after ~~Depth to~~ Water: 20.50 @ 14:30 20.48 @ 14:55 (from TPVC)

Depth to Bottom: ______ (from TPVC)

Length of Water: ______

Free Product Observed: ☐ Yes ☐ No Thickness: ______

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: ______ Sampling Device: ______

Volume Required: ______ ☐ See back of page for field readings during purge

Volume Purged: ______

Could Well Bail Dry? ☐ Yes ☐ No

Purging - Time Start: ______ Time Ended: ______

Decon Method: ______

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque

Odor: ______

Color ______

pH @ ______ degrees C

Uncorrected Conductivity ______ X ______

Water Temp. (from Cond.) ______

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Comments: took out 20 gallons w/ bailer

Well Purging Log

Date 11-24-09

Time	Temp	pH	Conductivity mS/cm	ORP	Turbidity
14:38	19.7	9.87	.475	-253	340
14:41	19.9	9.87	.464	-261	57
14:44	20.0	9.77	.459	-258	17
14:46	20.0	9.73	.456	-260	11
14:49	20.0	9.70	.454	-261	8
14:52	20.0	9.69	.453	-261	7
14:55	20.0	9.69	.453	-261	6

Field Well ~~Sampling~~ Sheet Development

Fill out the entire form. If it does not apply, mark N/A.

AECOM

Project Name: Clark Landfill
Project No. ____
Location: GW-204 S
Tester: ____
Well Number: Clark Landfill
Date Sampled: 10/20/09
~~Previous Well Sampled:~~ Depth to water before Development: 20.40 @ 8:45

GENERAL CONDITIONS:

					If Missing Replaced?	
Surface Seal:	☐ Ok	☐ Damaged	☐ Missing:		Yes	No
Protector Pipe:	☐ Ok	☐ Damaged	☐ Missing:		Yes	No
Well Cap:	☐ Ok	☐ Damaged	☐ Missing:		Yes	No
Ambient Temperature: ___ °F	☐ Clear	☐ Cloudy	☐ Rain			

WELL DATA:

Measuring Device: ____
Stick Up or Down: ____ (from Ground Surface)
after Development Depth to Water: 20.40 @ 9:25 (from TPVC) ~21 gallons removed
Depth to Bottom: ____ (from TPVC)
Length of Water: ____
Free Product Observed: ☐ Yes ☐ No Thickness: ____

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: ____ Sampling Device: ____
Volume Required: ____ ☐ See back of page for field readings during purge
Volume Purged: ____
Could Well Bail Dry? ☐ Yes ☐ No
Purging - Time Start: ____ Time Ended: ____
Decon Method: ____

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque
Odor: ____
Color ____
pH @ ____ degrees C
Uncorrected Conductivity ____ X ____
Water Temp. (from Cond.) ____

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

cal. pH 3.97
cond. 4.50 mS/cm
turb. 0
temp. 10.9°C
7.0 pH 6.95 @ 10.3°C

Comments: Surged + purged x 30 minutes
Pumped till parameters stabilized - see back
start at 8:45 end at 9:45

Well Purging Log

Date 11/2019

18 gallons removed

Time	Temp	pH	Conductivity	ORP	Turbidity
9:25	16.9	10.86	1.58	-259	180
9:28	17.4	11.31	1.65	-284	30
9:33	17.7	11.94	1.65	-311	13
9:36	17.9	12.07	1.65	-312	10
9:39	17.9	12.13	1.66	-308	6
9:42	17.9	12.16	1.66	-318	5
9:45	18.0	12.15	1.66	-328	4

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

AECOM

10/24
24.00
@ 10:15

Project Name: Clark Landfill Project No. ______

Location: ______ Tester: ______

Well Number: MW-202S Date Sampled: 10/20/09

~~Previous Well Sampled:~~ Depth to water before development: 24.07 @ 10:00

GENERAL CONDITIONS: If Missing Replaced?

Surface Seal:	☐ Ok	☐ Damaged	☐ Missing:	Yes No
Protector Pipe:	☐ Ok	☐ Damaged	☐ Missing:	Yes No
Well Cap:	☐ Ok	☐ Damaged	☐ Missing:	Yes No
Ambient Temperature: ____ °F	☐ Clear	☐ Cloudy	☐ Rain	

WELL DATA:

purging start 10:27

Measuring Device: ______

Stick Up or Down: ______ (from Ground Surface)

after development Depth to Water: 24.00 @ 11:35 (from TPVC)

Depth to Bottom: ______ (from TPVC)

Length of Water: ______

Free Product Observed: ☐ Yes ☐ No Thickness: ______

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: ______ Sampling Device: ______

Volume Required: ______ ☐ See back of page for field readings during purge

Volume Purged: ______

Could Well Bail Dry? ☐ Yes ☐ No

Purging - Time Start: ______ Time Ended: ______

Decon Method: ______

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque

Odor: ______

Color ______

pH @ ______ degrees C

Uncorrected Conductivity ______ X ______

Water Temp. (from Cond.) ______

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

pH 3.96
Cond. 4.50 mS/cm
turb 0
temp 11.0°C
pH 7 @ 9.8°C

Comments: pump failed ~~collected~~ 10 gallons w/ bailer

needs more pump development

10/24 - Pumped 48 gallons

Well Purging Log

Date 10/24

Time	Temp	pH	Conductivity	ORP	Turbidity
11:13	17.7	11.47	2.99	-201	-10
11:16	17.9	11.59	2.99	-264	-10
11:19	18.0	11.52	3.01	-270	60
11:21	18.1	11.52	3.00	-245	47
11:24	18.1	11.51	2.98	-257	10
11:27	18.1	11.51	2.98	-260	9
11:30	18.1	11.51	2.98	-262	8

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

AECOM 11/24
8.65 @ 11:5

Project Name: Clark Landfill Project No. ______

Location: ______ Tester: ______

Well Number: MW-203S Date Sampled: 11/20/09

~~Previous Well Sampled~~: WL before purge: 8.70 @ 12:20

GENERAL CONDITIONS: If Missing Replaced?

Surface Seal: [ ] Ok [ ] Damaged [ ] Missing: Yes No

Protector Pipe: [ ] Ok [ ] Damaged [ ] Missing: Yes No

Well Cap: [ ] Ok [ ] Damaged [ ] Missing: Yes No

Ambient Temperature: ___ °F [ ] Clear [ ] Cloudy [ ] Rain

WELL DATA:

Measuring Device: ______

Stick Up or Down: 11/20 11/24 (from Ground Surface)

WL after ~~Depth to Water~~: 8.66 @ 13:16 8.55 @ 12:52 (from TPVC)

Depth to Bottom: ______ (from TPVC)

Length of Water: ______

Free Product Observed: [ ] Yes [ ] No Thickness: ______

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: ______ Sampling Device: ______

Volume Required: ______ [ ] See back of page for field readings during purge

Volume Purged: ______

Could Well Bail Dry? [ ] Yes [ ] No

Purging - Time Start: ______ Time Ended: ______

Decon Method: ______

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque

Odor: ______

Color ______

pH @ ______ degrees C

Uncorrected Conductivity ______ X ______

Water Temp. (from Cond.) ______

SAMPLES COLLECTED

Vocs -	[ ]	Cyanide	[ ]
Metals -	[ ]	Hexchrome	[ ]
SVOC	[ ]	Alkalinity	[ ]
TOC	[ ]	Chloride	[ ]
Sulfide	[ ]	Ammonia	[ ]
Phenolics	[ ]	COD	[ ]

Comments: bailed out 20 gallons, still needs pump development

11/24 Pumped 44 gallons

Well Purging Log

Date 10/20/09

Time	Temp	pH	Conductivity	ORP	Turbidity
13:15	18.9°	12.27	1.92	-269	66
	~~DAN~~				10/24/09
12:35	20.1	11.16	2.02	-306	76
12:38	20.3	11.44	2.53	-316	15
12:41	20.4	11.43	2.52	-320	6
12:43	20.4	11.43	2.52	-323	5
12:46	20.4	11.42	2.52	-326	4

Appendix C

Horizontal Hydraulic Gradient and Seepage (Linear) Velocity Calculations

Horizontal Hydraulic Gradient - MW-201S to MW-203S

May 3, 2011

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-201S, MW-203S

L = Distance between wells		1340 ft
h1 = groundwater elevation at	MW-201S	579.8 ft
h2 = groundwater elevation at	MW-203S	578.62 ft

i = 0.00088 ft/ft

Linear Velocity (Seepage Velocity) - MW-201S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-201S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.369558008
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	1.21E-02
i = Horizontal gradient	0.000880597
Ne = Effective porosity (estimated)	0.25

$$v = \frac{1.21E-02 \text{ ft/sec} \times 0.000880597 \text{ ft/ft}}{0.25}$$

$$= 4.2697E-05 \text{ ft/sec} \times 3.15E+07 \text{ sec/yr}$$

v = 1344.94 ft/yr

Prepared by/Date:______________________________

Checkec by/Date:______________________________

Horizontal Hydraulic Gradient - MW-201S to MW-203S

January 25, 2011

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-201S, MW-203S

L = Distance between wells		1340	ft
h1 = groundwater elevation at	MW-201S	579.14	ft
h2 = groundwater elevation at	MW-203S	577.82	ft

i = 0.00099 ft/ft

Linear Velocity (Seepage Velocity) - MW-201S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-201S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.369558008
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	1.21E-02
i = Horizontal gradient	0.000985075
Ne = Effective porosity (estimated)	0.25

$$v = \frac{1.21E\text{-}02 \text{ ft/sec} \quad X \quad 0.000985075 \text{ ft/ft}}{0.25}$$

= 4.7762E-05 ft/sec X 3.15E+07 sec/yr

v = 1504.51 ft/yr

Prepared by/Date:____________________

Checkec by/Date:____________________

Horizontal Hydraulic Gradient - MW-201S to MW-203S

October 28, 2010

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-201S, MW-203S

L = Distance between wells		1340 ft
h1 = groundwater elevation at	MW-201S	578.94 ft
h2 = groundwater elevation at	MW-203S	577.86 ft

i = 0.00081 ft/ft

Linear Velocity (Seepage Velocity) - MW-201S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-201S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.369558008
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	1.21E-02
i = Horizontal gradient	0.00080597
Ne = Effective porosity (estimated)	0.25

$$v = \frac{1.21E-02 \text{ ft/sec} \times 0.00080597 \text{ ft/ft}}{0.25}$$

$$= 3.9078E-05 \text{ ft/sec} \times 3.15E+07 \text{ sec/yr}$$

v = 1230.97 ft/yr

Prepared by/Date:____________________

Checkec by/Date:____________________

Horizontal Hydraulic Gradient - MW-201S to MW-203S

August 30, 2010

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-201S, MW-203S

L = Distance between wells		1340	ft
h1 = groundwater elevation at	MW-201S	580.31	ft
h2 = groundwater elevation at	MW-203S	579	ft

i = 0.00098 ft/ft

Linear Velocity (Seepage Velocity) - MW-201S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-201S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.369558008
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	1.21E-02
i = Horizontal gradient	0.000977612
Ne = Effective porosity (estimated)	0.25

$$v = \frac{1.21E-02 \text{ ft/sec} \quad X \quad 0.000977612 \text{ ft/ft}}{0.25}$$

= 4.7401E-05 ft/sec X 3.15E+07 sec/yr

v = 1493.12 ft/yr

Prepared by/Date:______________________________

Checkec by/Date:______________________________

Horizontal Hydraulic Gradient - MW-201S to MW-203S

April 12, 2010

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-201S, MW-203S

L = Distance between wells		1340	ft
h1 = groundwater elevation at	MW-201S	580.02	ft
h2 = groundwater elevation at	MW-203S	578.95	ft

i = 0.00080 ft/ft

Linear Velocity (Seepage Velocity) - MW-201S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-201S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.369558008
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	1.21E-02
i = Horizontal gradient	0.000798507
Ne = Effective porosity (estimated)	0.25

$$v = \frac{1.21E-02 \text{ ft/sec} \quad X \quad 0.000798507 \text{ ft/ft}}{0.25}$$

= 3.8716E-05 ft/sec X 3.15E+07 sec/yr

v = 1219.57 ft/yr

Prepared by/Date:______________________

Checkec by/Date:______________________

Horizontal Hydraulic Gradient - MW-202S to MW-203S

April 12, 2010

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-202S, MW-203S

L = Distance between wells		950	ft
h1 = groundwater elevation at	MW-202S	579.22	ft
h2 = groundwater elevation at	MW-203S	578.95	ft

i = 0.00028 ft/ft

Linear Velocity (Seepage Velocity) - MW-202S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-202S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.200858776
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	6.59E-03
i = Horizontal gradient	0.000284211
Ne = Effective porosity (estimated)	0.25

$$v = \frac{6.59E-03 \text{ ft/sec} \quad X \quad 0.000284211 \text{ ft/ft}}{0.25}$$

= 7.4897E-06 ft/sec X 3.15E+07 sec/yr

v = 235.93 ft/yr

Prepared by/Date:________________________

Checkec by/Date:________________________

Horizontal Hydraulic Gradient - MW-202S to MW-203S

August 30, 2010

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-202S, MW-203S

L = Distance between wells		950 ft
h1 = groundwater elevation at	MW-202S	579.5 ft
h2 = groundwater elevation at	MW-203S	579 ft

i = 0.00053 ft/ft

Linear Velocity (Seepage Velocity) - MW-202S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-202S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.200858776
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	6.59E-03
i = Horizontal gradient	0.000526316
Ne = Effective porosity (estimated)	0.25

$$v = \frac{6.59E-03 \text{ ft/sec} \times 0.000526316 \text{ ft/ft}}{0.25}$$

= 1.387E-05 ft/sec X 3.15E+07 sec/yr

v = 436.90 ft/yr

Prepared by/Date:______________________

Checkec by/Date:______________________

Horizontal Hydraulic Gradient - MW-202S to MW-203S

October 28, 2010

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-202S, MW-203S

L = Distance between wells		950	ft
h1 = groundwater elevation at	MW-202S	578.04	ft
h2 = groundwater elevation at	MW-203S	577.86	ft

i = 0.00019 ft/ft

Linear Velocity (Seepage Velocity) - MW-202S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-202S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.200858776
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	6.59E-03
i = Horizontal gradient	0.000189474
Ne = Effective porosity (estimated)	0.25

v = 6.59E-03 ft/sec X 0.000189474 ft/ft / 0.25

= 4.9931E-06 ft/sec X 3.15E+07 sec/yr

v = 157.28 ft/yr

Prepared by/Date:____________________

Checkec by/Date:____________________

Horizontal Hydraulic Gradient - MW-202S to MW-203S

January 25, 2011

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-202S, MW-203S

L = Distance between wells		950	ft
h1 = groundwater elevation at	MW-202S	578.16	ft
h2 = groundwater elevation at	MW-203S	577.82	ft

i = 0.00036 ft/ft

Linear Velocity (Seepage Velocity) - MW-202S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-202S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.200858776
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	6.59E-03
i = Horizontal gradient	0.000357895
Ne = Effective porosity (estimated)	0.25

$$v = \frac{6.59E-03 \text{ ft/sec} \quad X \quad 0.000357895 \text{ ft/ft}}{0.25}$$

$$= 9.4315E-06 \text{ ft/sec} \quad X \quad 3.15E+07 \text{ sec/yr}$$

v = 297.09 ft/yr

Prepared by/Date:____________________

Checkec by/Date:____________________

Horizontal Hydraulic Gradient - MW-202S to MW-203S

May 3, 2011

$$i = \frac{h1-h2}{L}$$

Wells Referenced in Calculation: MW-202S, MW-203S

L = Distance between wells		950	ft
h1 = groundwater elevation at	MW-202S	579.06	ft
h2 = groundwater elevation at	MW-203S	578.62	ft

i = 0.00046 ft/ft

Linear Velocity (Seepage Velocity) - MW-202S to MW-203S

$$v = \frac{Ka * i}{Ne}$$

Wells Referenced in Calculation: MW-202S, MW-203S

v = Linear groundwater flow velocity	
Ka = Mean hydraulic conductivity (geometric)	0.200858776
Conversion factor for cm/sec to ft/sec = cm/sec *3.28E-2	6.59E-03
i = Horizontal gradient	0.000463158
Ne = Effective porosity (estimated)	0.25

$$v = \frac{6.59E-03 \text{ ft/sec} \times 0.000463158 \text{ ft/ft}}{0.25}$$

$$= 1.2205E-05 \text{ ft/sec} \times 3.15E+07 \text{ sec/yr}$$

v = 384.47 ft/yr

Prepared by/Date:__________________________

Checkec by/Date:__________________________

Appendix D

Groundwater Sampling Field Sheets

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

AECOM

Project Name: Clark Landfill Project No. 60157738

Location: ____ Tester: MPW

Well Number: MW-201S Date Sampled: 6/9/10

Previous Well Sampled: N/A

GENERAL CONDITIONS: If Missing Replaced?

Surface Seal:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Protector Pipe:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Well Cap:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes	No
Ambient Temperature: 80 °F	[X] Clear	[ ] Cloudy	[ ] Rain		

WELL DATA:

Measuring Device: Solinst Water Level Meter

Stick Up or Down: UP (from Ground Surface)

Depth to Water: 20.23 ft (from TPVC)

Depth to Bottom: 26.72 ft (from TPVC)

Length of Water: 6.49 ft

Free Product Observed: [ ] Yes [X] No Thickness: ____

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Peristaltic Pump Sampling Device: Same

Volume Required: Low Flow [✓] See back of page for field readings during purge

Volume Purged: ~2 gal purge only

Could Well Bail Dry? [ ] Yes [✓] No

Purging - Time Start: 1010 Time Ended: ~~[illegible]~~ 1055

Decon Method: Disposable tubing N/A

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque

Odor: ____

Color ____

pH @ ____ degrees C

Uncorrected Conductivity X

Water Temp. (from Cond.) ____

SAMPLES COLLECTED

Vocs -	[ ]	Cyanide	[ ]
Metals -	[ ]	Hexchrome	[ ]
SVOC	[ ]	Alkalinity	[ ]
TOC	[ ]	Chloride	[ ]
Sulfide	[ ]	Ammonia	[ ]
Phenolics	[ ]	COD	[ ]

Comments: See other side

Well Purging Log

Date 6/9/10

Time	Temp (°C)	pH (S.U.)	Conductivity (mS/cm)	ORP (mV)	Turbidity (NTU)	WL
Horiba Calibration	22.1	pH 4 = 3.99	4.48	—	0	
		pH 7 = 7.00				
250 ml/min 1010	20.2	11.26	1.20	-323	42	
1015	20.2	11.00	1.12	-322	10	20.25
1020	20.4	9.65	0.489		5	
pumping stopped briefly due to equipment set-up malfunction						
Re-set and pumping started @ 1027						
1030	20.5	9.41	0.370	-220	76	
1035	20.6	9.23	0.366	-218	38	20.24
1040	20.8	9.08	0.359	-209	4	
1045	20.9	9.13	0.357	-209	5	
1050	21.0	9.21	0.356	-207	5	

ST = 1055

MS ST = 1130

MSD ST = 1215

Pump stopped @ 1230

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

AECOM

Project Name: Clark Landfill GW Sampling Project No. 60157738

Location: ______ Tester: MDW

Well Number: MW-202S Date Sampled: 6/9/10

Previous Well Sampled: MW-201S

GENERAL CONDITIONS:

				If Missing Replaced?
Surface Seal:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes No
Protector Pipe:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes No
Well Cap:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes No
Ambient Temperature: 80 °F	[X] Clear	[ ] Cloudy	[ ] Rain	

WELL DATA:

Measuring Device: Solinst Water Level Meter

Stick Up or Down: Up (from Ground Surface)

Depth to Water: 24.06 ft (from TPVC)

Depth to Bottom: 29.64 ft (from TPVC)

Length of Water: 5.58 ft

Free Product Observed: [ ] Yes [✓] No Thickness: ______

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Peristaltic Pump Sampling Device: Same

Volume Required: Low Flow [✓] See back of page for field readings during purge

Volume Purged: ~2.1 gal purge only

Could Well Bail Dry? [ ] Yes [✓] No

Purging - Time Start: 1350 Time Ended: 1415

Decon Method: Disposable tubing N/A

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque

Odor: ______

Color ______

pH @ ______ degrees C

Uncorrected Conductivity ______ X ______

Water Temp. (from Cond.) ______

SAMPLES COLLECTED

Vocs -	[ ]	Cyanide	[ ]
Metals -	[ ]	Hexchrome	[ ]
SVOC	[ ]	Alkalinity	[ ]
TOC	[ ]	Chloride	[ ]
Sulfide	[ ]	Ammonia	[ ]
Phenolics	[ ]	COD	[ ]

Comments: See other side

Well Purging Log

Date 6/9/10

Time	°C Temp	S.U. pH	mS/cm Conductivity	ORP mV	NTU Turbidity	WL
1350 pump started @ ~400 ml/min						
1355	18.7	11.79	2.15	-89	25	24.09
1400	18.3	11.80	2.15	-96	5	
1405	18.1	11.81	2.22	-107	6	24.10
1410	18.1	11.82	2.22	-111	3	
1415	18.1	11.83	2.23	-113	2	
ST=1415						

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

AECOM

Project Name: Clark Landfill GW Sampling Project No. 60157738

Location: ____ Tester: MDW

Well Number: MW-203S Date Sampled: 6/9/10

Previous Well Sampled: MW-202S

GENERAL CONDITIONS: If Missing Replaced?

Surface Seal:	☑ Ok	☐ Damaged	☐ Missing:	Yes	No
Protector Pipe:	☑ Ok	☐ Damaged	☐ Missing:	Yes	No
Well Cap:	☑ Ok	☐ Damaged	☐ Missing:	Yes	No
Ambient Temperature: 80 °F	☑ Clear	☐ Cloudy	☐ Rain		

WELL DATA:

Measuring Device: Solinst/Water Level meter

Stick Up or Down: UP (from Ground Surface)

Depth to Water: 8.95 (from TPVC)

Depth to Bottom: 14.70 (from TPVC)

Length of Water: 5.75

Free Product Observed: ☐ Yes ☑ No Thickness: ____

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Perastaltic Pump Sampling Device: Same

Volume Required: Low Flow ☑ See back of page for field readings during purge

Volume Purged: ~4.2 gal Purge only

Could Well Bail Dry? ☐ Yes ☑ No

Purging - Time Start: 1600 Time Ended: 1640

Decon Method: Disposable tubing / N/A

IN-SITU TESTING:

Turbidity: ☐ Turbid ☐ Opaque

Odor: ____

Color ____

pH @ ____ degrees C

Uncorrected Conductivity ____ X ____

Water Temp. (from Cond.) ____

SAMPLES COLLECTED

Vocs -	☐	Cyanide	☐
Metals -	☐	Hexchrome	☐
SVOC	☐	Alkalinity	☐
TOC	☐	Chloride	☐
Sulfide	☐	Ammonia	☐
Phenolics	☐	COD	☐

Comments: See other Side

Well Purging Log

Date 6/9/10

Time	°C Temp	S.U. pH	µS/cm Conductivity	mV ORP	NTU Turbidity	WL
Start pump @ 1600 @ ~400 mL/min						
1605	20.2	11.92	1.97	-262	576	
1610	19.9	11.77	1.99	-327	133	9.00
1615	19.6	11.77	2.00	-317	94	
1620	19.6	11.80	2.01	-333	50	
1625	19.6	11.79	2.01	-339	34	
1630	19.6	11.78	2.01	-330	17	
1635	19.6	11.79	2.00	-333	10	
1640	19.6	11.80	2.01	-336	12	

Field Blank ST=1615 w/ Distilled water

Dup ST=1640

ST=1705

Field Well Sampling Sheet

Fill out the entire form. If it does not apply, mark N/A.

AECOM

Project Name: Clark Landfill GW. Sampling Project No. 60157738
Location: ______ Tester: MDW
Well Number: MW-204 S Date Sampled: 6/9
Previous Well Sampled: MW-203 S

GENERAL CONDITIONS:

				If Missing Replaced?
Surface Seal:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes No
Protector Pipe:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes No
Well Cap:	[✓] Ok	[ ] Damaged	[ ] Missing:	Yes No
Ambient Temperature: 80 °F		[ ] Clear [ ] Cloudy	[ ] Rain	

WELL DATA:

Measuring Device: Solinst Water Level Meter
Stick Up or Down: UP (from Ground Surface)
Depth to Water: 20.46 ft (from TPVC)
Depth to Bottom: 24.62 ft (from TPVC)
Length of Water: 4.16 ft
Free Product Observed: [ ] Yes [✓] No Thickness: ______

PURGING/SAMPLING:

Well Purging Calculations: Amount to purge = 0.163 gallons/foot times height of water column in feet for one well volume

Purging Device: Peristaltic Pump Sampling Device: Same
Volume Required: Low Flow [✓] See back of page for field readings during purge
Volume Purged: ~2.6 gal
Could Well Bail Dry? [ ] Yes [✓] No
Purging - Time Start: 1755 Time Ended: 1820
Decon Method: Disposable tubing N/A

IN-SITU TESTING:

Turbidity: [ ] Turbid [ ] Opaque
Odor: ______
Color ______
pH @ ______ degrees C
Uncorrected Conductivity ______ X ______
Water Temp. (from Cond.) ______

SAMPLES COLLECTED

Vocs -	[ ]	Cyanide	[ ]
Metals -	[ ]	Hexchrome	[ ]
SVOC	[ ]	Alkalinity	[ ]
TOC	[ ]	Chloride	[ ]
Sulfide	[ ]	Ammonia	[ ]
Phenolics	[ ]	COD	[ ]

Comments: See other side

Well Purging Log

Date 6/9/10

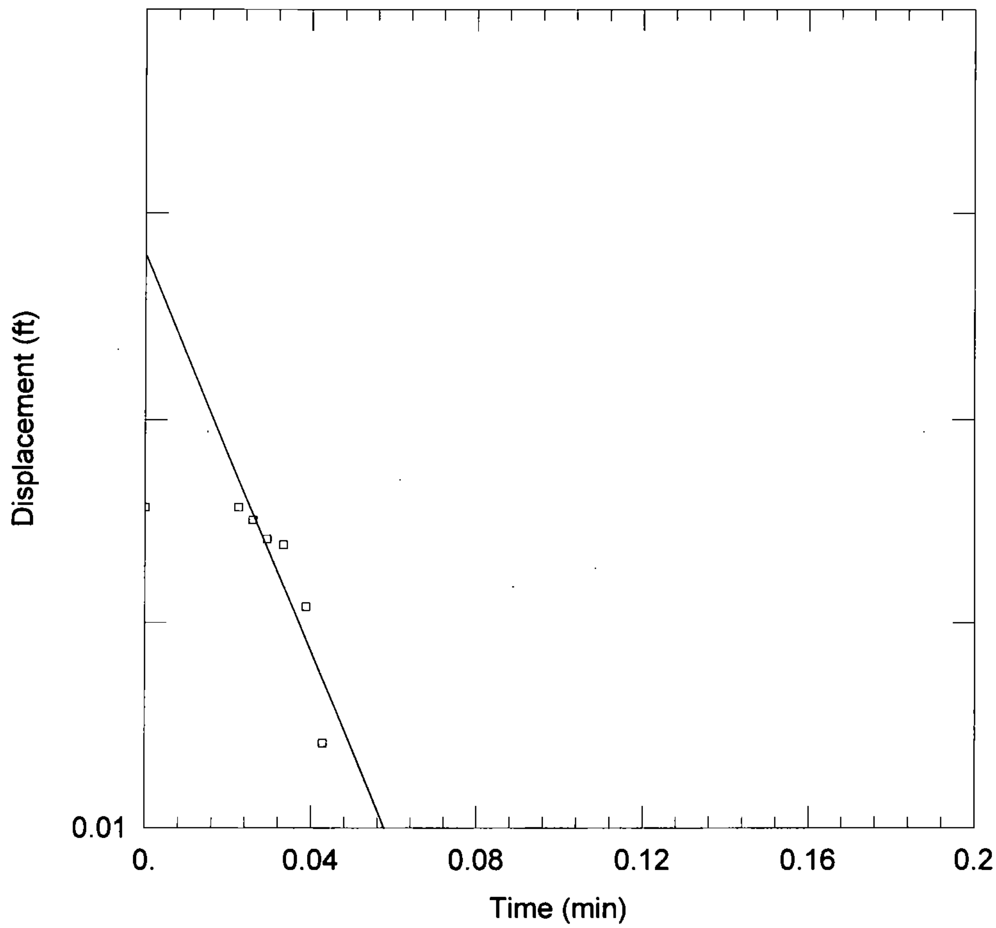
Time	°C Temp	S.U. pH	mS/cm Conductivity	mV ORP	NTU Turbidity	WL
Pump Started @ 1755 @ ~ 400 mL/min						
1800	18.2	11.82	1.57	-236	5	20.46
1805	18.1	11.72	1.57	-240	5	
1810	18.0	11.60	1.58	-234	5	
1815	18.0	11.57	1.58	-239	5	
1820	18.0	11.56	1.58	-240	5	

ST = 1820

Rinsate Blank ST = 1840

Appendix E

Hydraulic Conductivity Field Data and Graphical Output



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-201S_1.aqt
Date: 02/24/10 Time: 11:53:56

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-201S Test 1
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 6.57 ft
Anisotropy Ratio (Kz/Kr): 1.

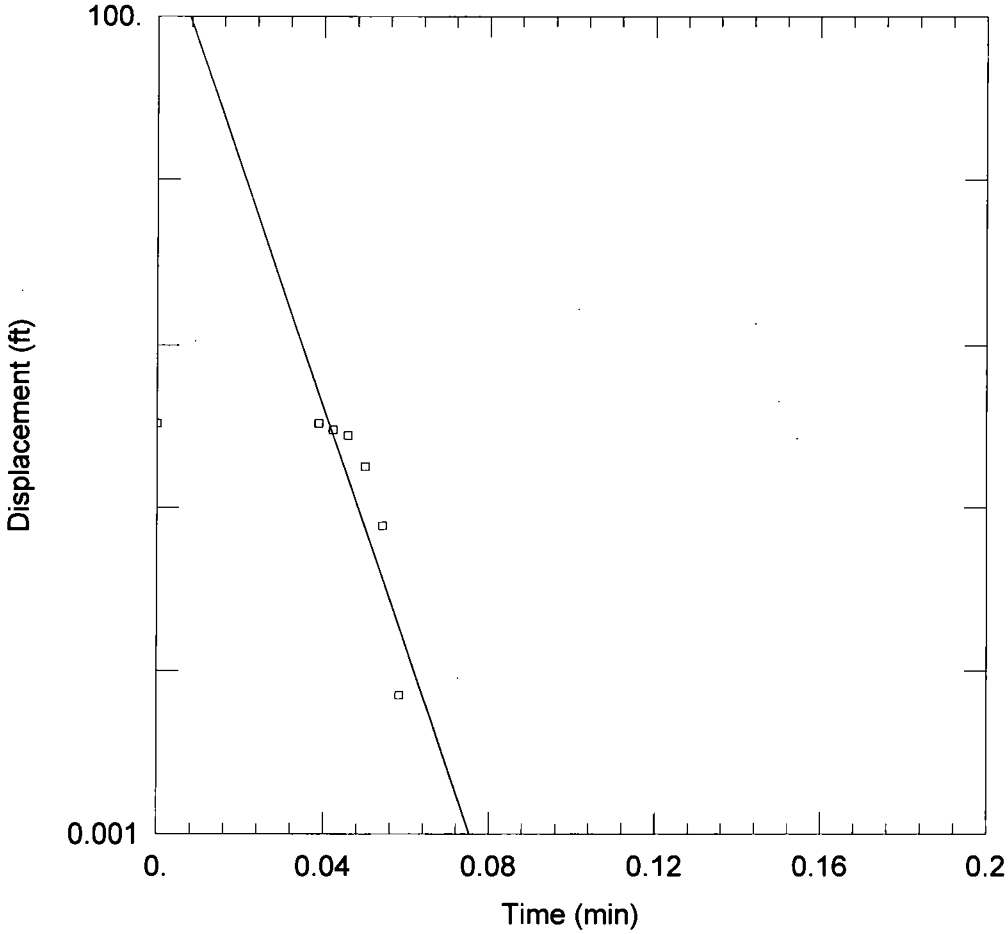
WELL DATA (MW-201S_T1)

Initial Displacement: 0.3733 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3333 ft
Well Skin Radius: 0.3333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 6.57 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.25 cm/sec
y0 = 6.18 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-201S_2.aqt
Date: 02/24/10 Time: 11:59:46

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-201S Test 2
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 6.57 ft
Anisotropy Ratio (Kz/Kr): 1.

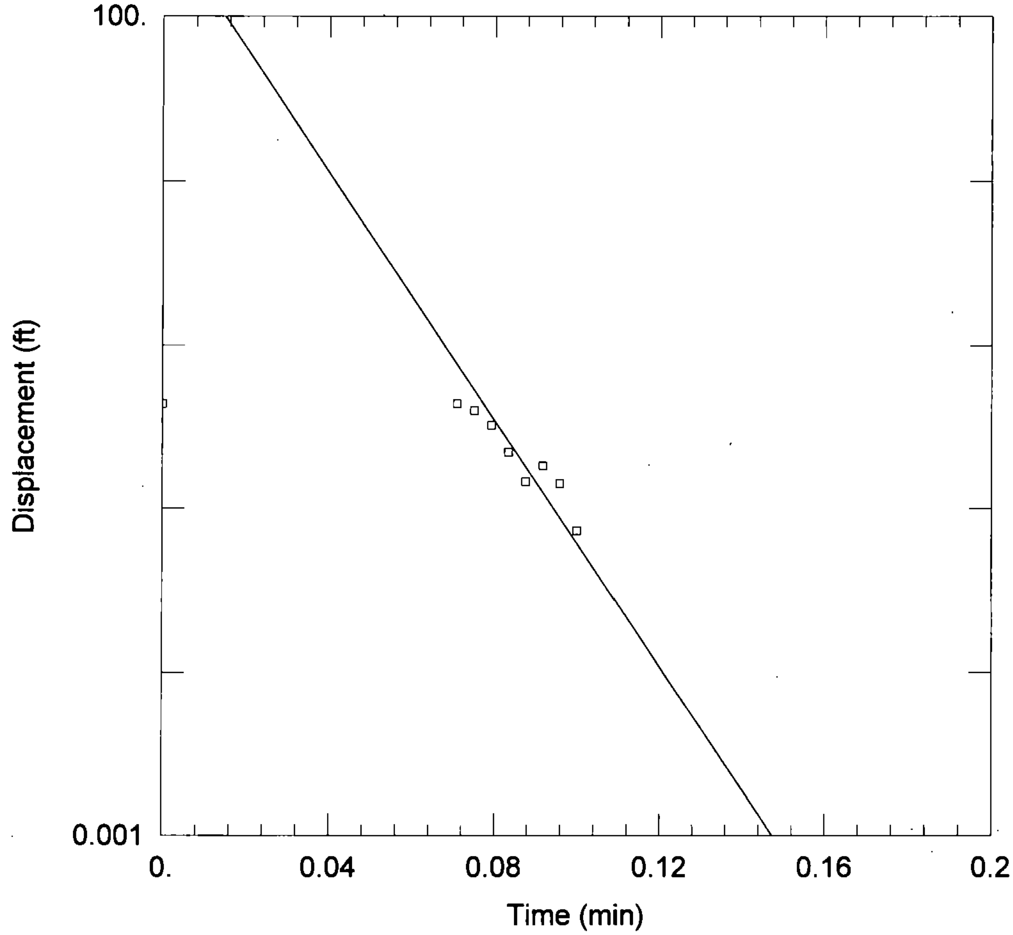
WELL DATA (MW-201S_T2)

Initial Displacement: 0.331 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3333 ft
Well Skin Radius: 0.3333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 6.57 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.38 cm/sec
y0 = 355.6 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-201S_3.aqt
Date: 02/24/10 Time: 12:03:33

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-201S Test 3
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 6.57 ft
Anisotropy Ratio (Kz/Kr): 1.

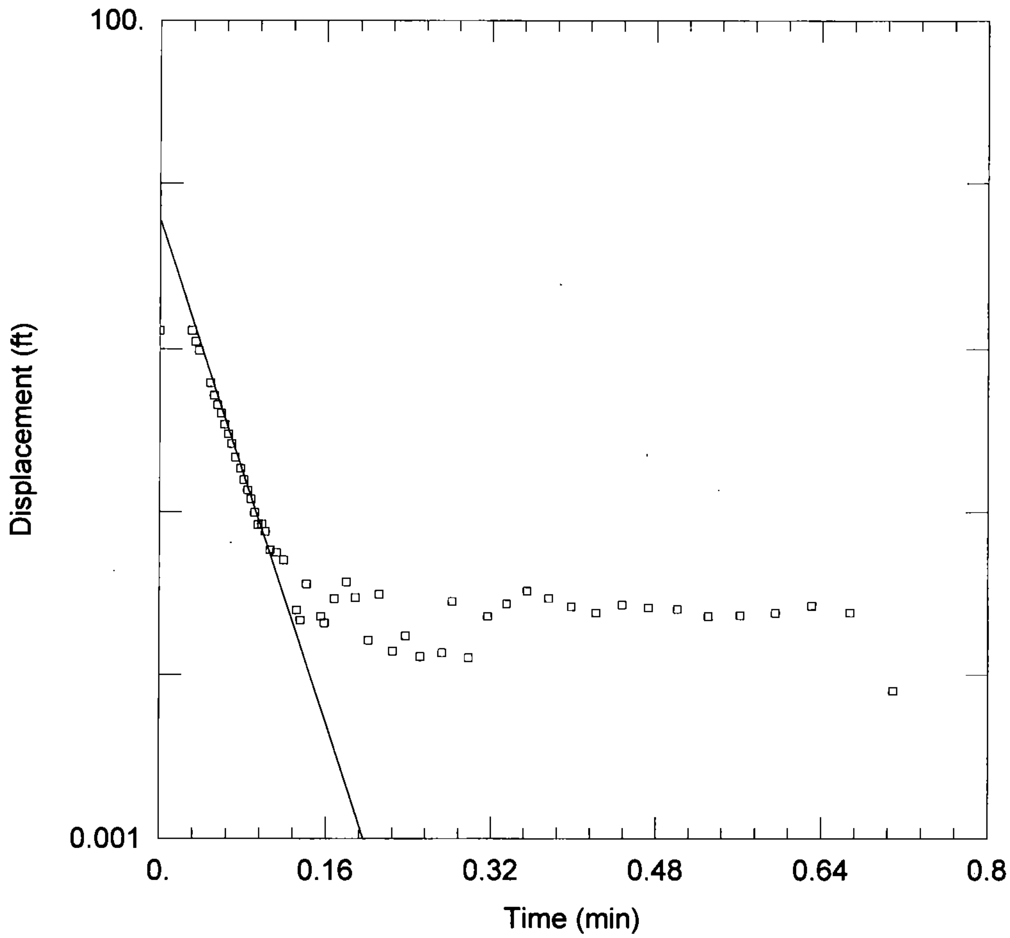
WELL DATA (MW-201S_T3)

Initial Displacement: 0.4378 ft
Wellbore Radius: 0.3333 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3
Casing Radius: 0.08333 ft
Well Skin Radius: 0.3333 ft
Total Well Penetration Depth: 6.57 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.1939 cm/sec
y0 = 355.6 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-202S_1.aqt
Date: 02/24/10 Time: 12:08:42

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-202S Test 1
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 5.76 ft
Anisotropy Ratio (Kz/Kr): 1.

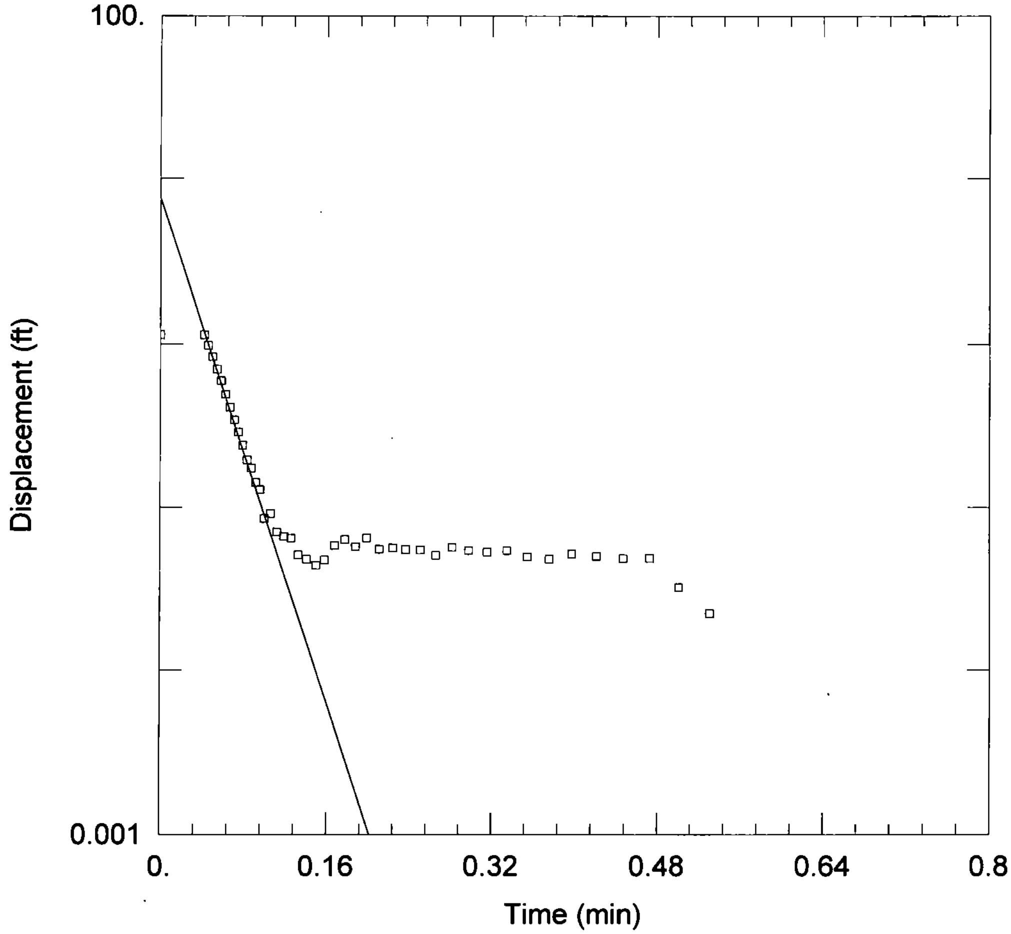
WELL DATA (MW-202S_T1)

Initial Displacement: 1.295 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3333 ft
Well Skin Radius: 0.3333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 5.76 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0954 cm/sec
y0 = 5.902 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-202S_2.aqt
Date: 02/24/10 Time: 12:12:46

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-202S Test 2
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 5.76 ft
Anisotropy Ratio (Kz/Kr): 1.

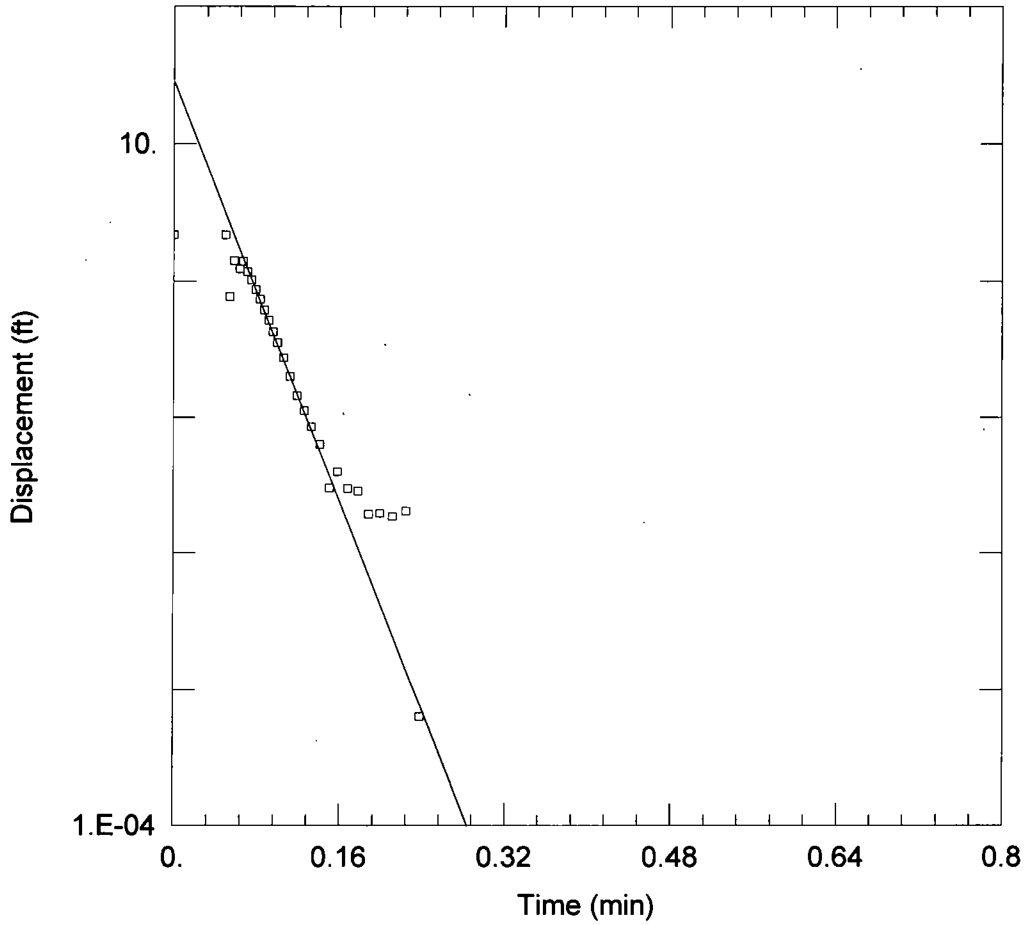
WELL DATA (MW-202S_T2)

Initial Displacement: 1.139 ft
Wellbore Radius: 0.3333 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3
Casing Radius: 0.08333 ft
Well Skin Radius: 0.3333 ft
Total Well Penetration Depth: 5.76 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0954 cm/sec
y0 = 7.431 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-202S_3.aqt
Date: 02/24/10 Time: 12:16:33

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-202S Test 3
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 5.76 ft
Anisotropy Ratio (Kz/Kr): 1.

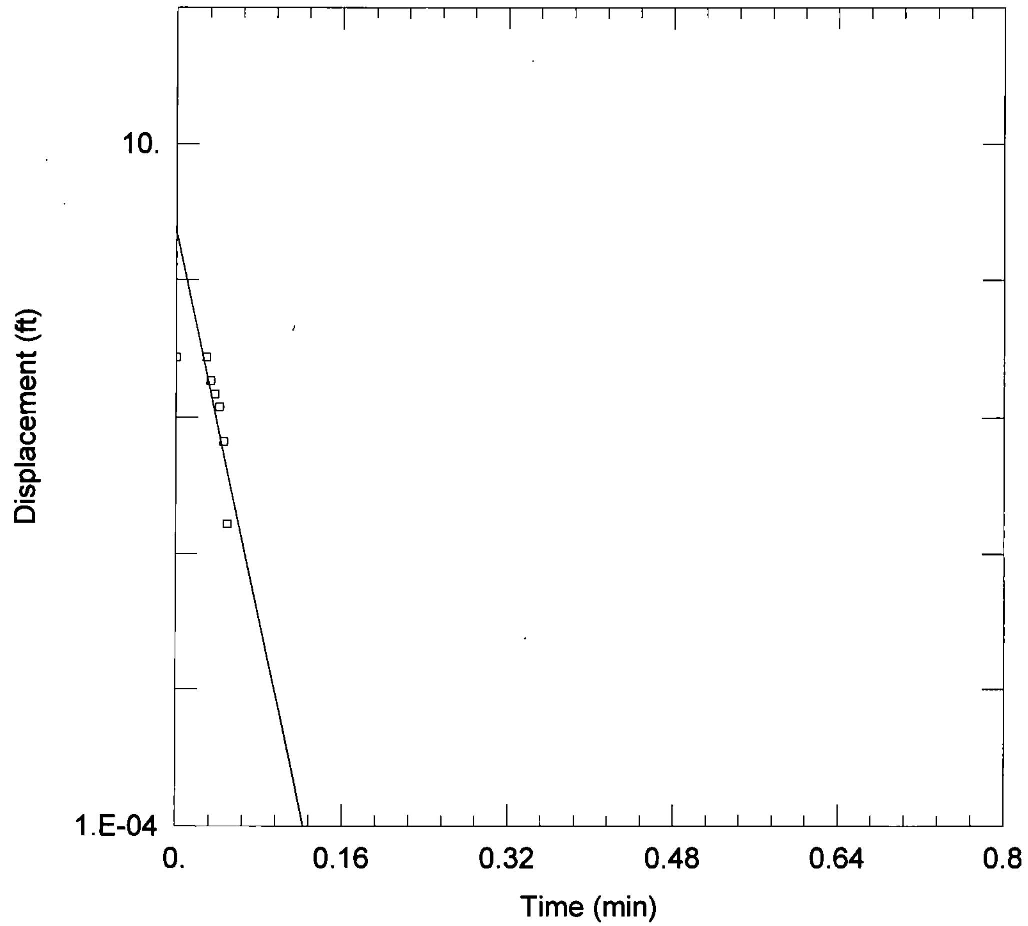
WELL DATA (MW-202S_T3)

Initial Displacement: 2.201 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3333 ft
Well Skin Radius: 0.3333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 5.76 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.0954 cm/sec
y0 = 28.25 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-203S_1.aqt
Date: 02/24/10 Time: 12:21:56

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-203S Test 1
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 6.04 ft
Anisotropy Ratio (Kz/Kr): 1.

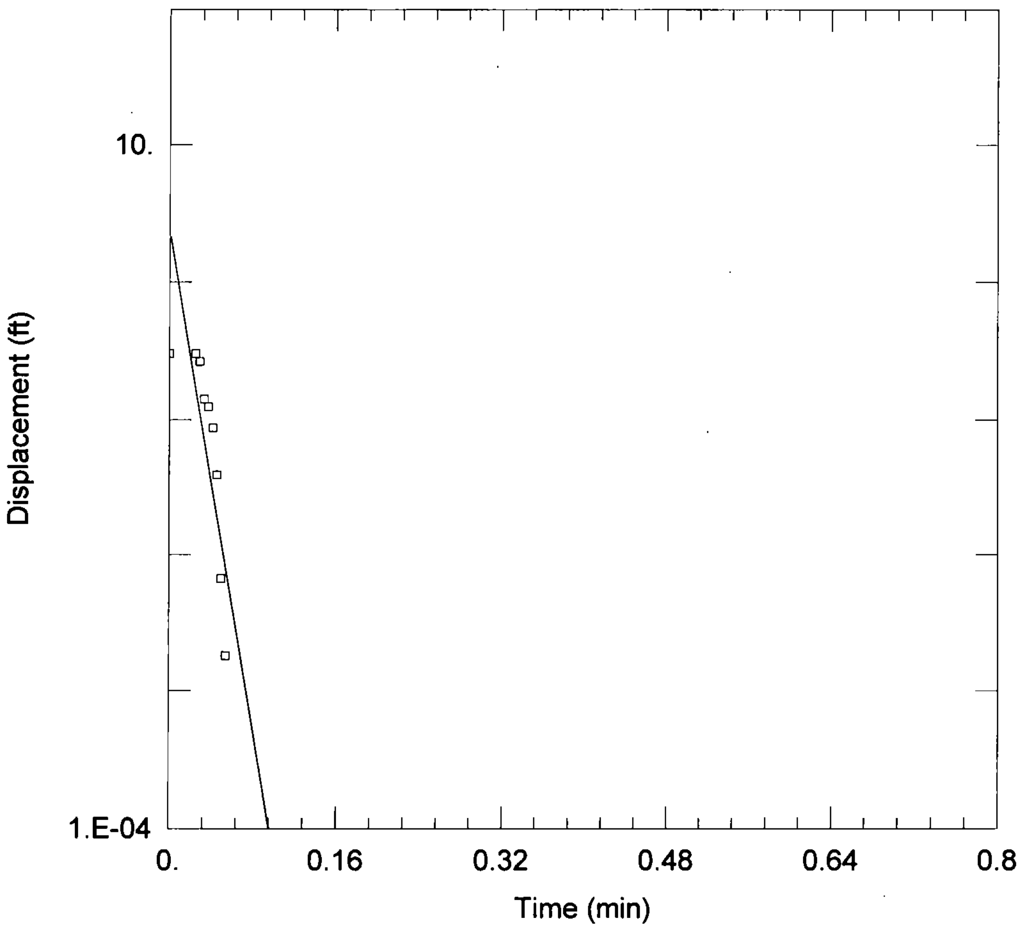
WELL DATA (MW-203S_T1)

Initial Displacement: 0.2726 ft
Wellbore Radius: 0.3333 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3
Casing Radius: 0.08333 ft
Well Skin Radius: 0.3333 ft
Total Well Penetration Depth: 6.04 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.1783 cm/sec
y0 = 2.143 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-203S_2.aqt
Date: 02/24/10 Time: 12:25:07

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-203S Test 2
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 6.04 ft
Anisotropy Ratio (Kz/Kr): 1.

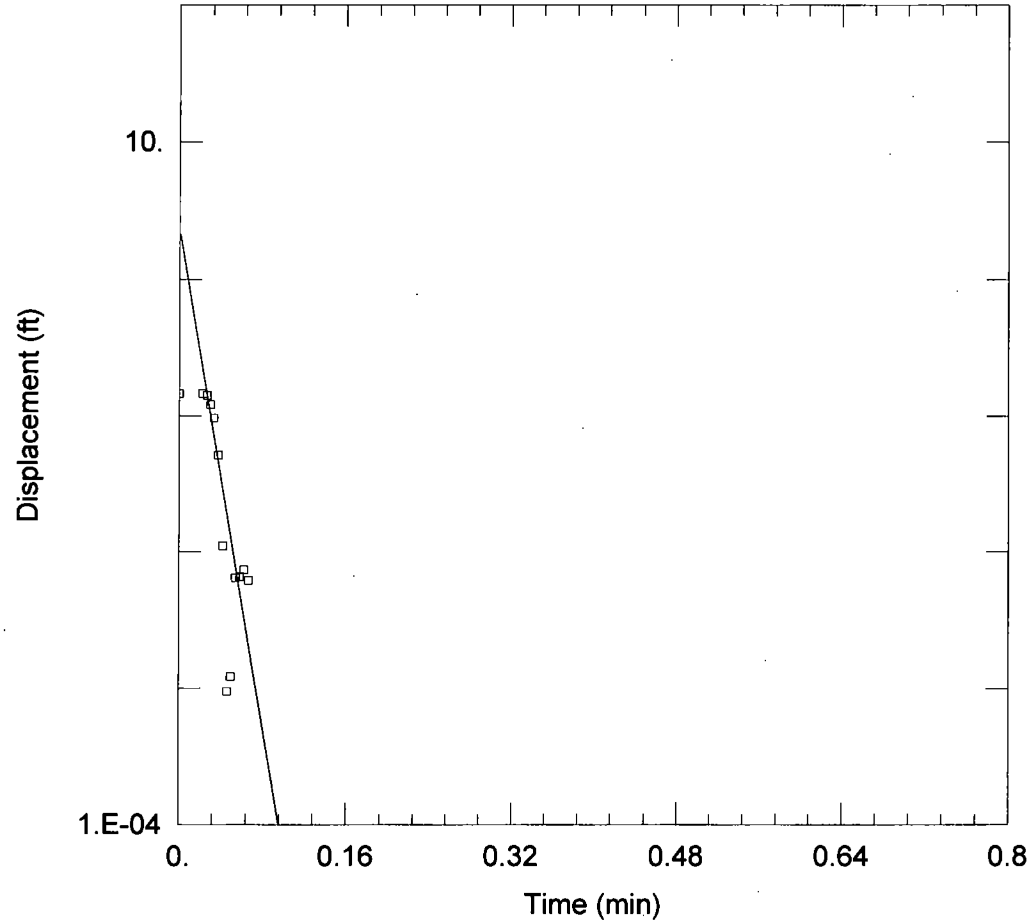
WELL DATA (MW-203S_T2)

Initial Displacement: 0.3049 ft
Wellbore Radius: 0.3333 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3
Casing Radius: 0.08333 ft
Well Skin Radius: 0.3333 ft
Total Well Penetration Depth: 6.04 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.2294 cm/sec
y0 = 2.143 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-203S_3.aqt
Date: 02/24/10 Time: 12:32:28

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-203S Test 3
Test Date: 2/12/2010

AQUIFER DATA

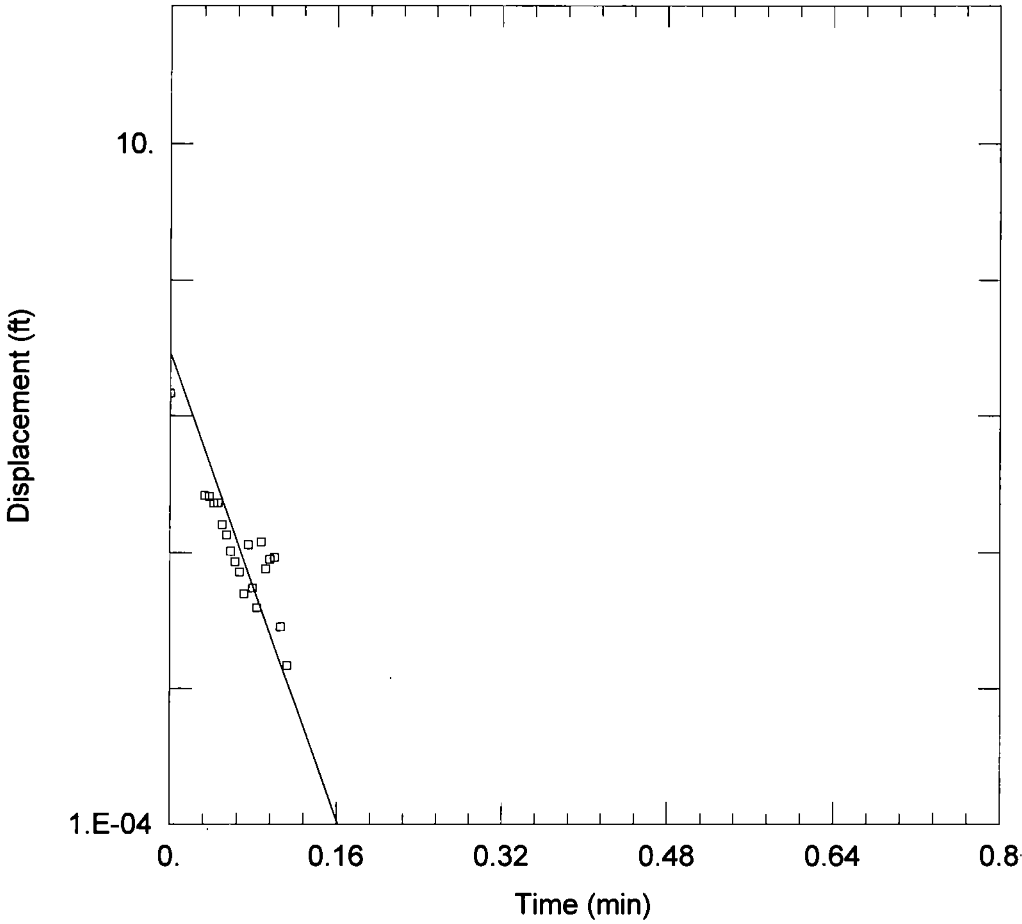
Saturated Thickness: 6.04 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-203S_T3)

Initial Displacement: 0.1467 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3333 ft
Well Skin Radius: 0.3333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 6.04 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice
K = 0.2294 cm/sec
y0 = 2.143 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-204S_1.aqt
Date: 02/24/10 Time: 12:37:20

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-204S Test 1
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 4.38 ft
Anisotropy Ratio (Kz/Kr): 1.

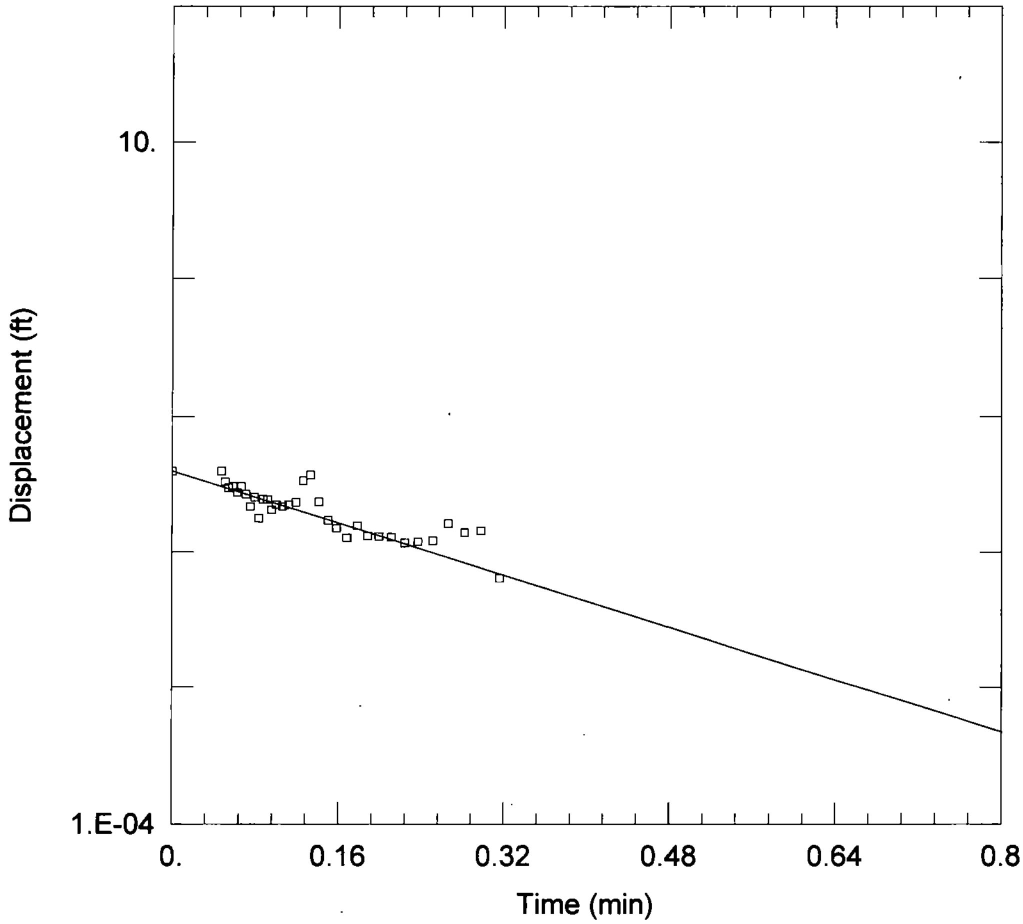
WELL DATA (MW-204S_T1)

Initial Displacement: 0.1467 ft
Casing Radius: 0.08333 ft
Wellbore Radius: 0.3333 ft
Well Skin Radius: 0.3333 ft
Screen Length: 10. ft
Total Well Penetration Depth: 4.38 ft
Gravel Pack Porosity: 0.3

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.09748 cm/sec
y0 = 0.2825 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-204S_2.aqt
Date: 02/24/10 Time: 12:41:52

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-204S Test 2
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 4.38 ft
Anisotropy Ratio (Kz/Kr): 1.

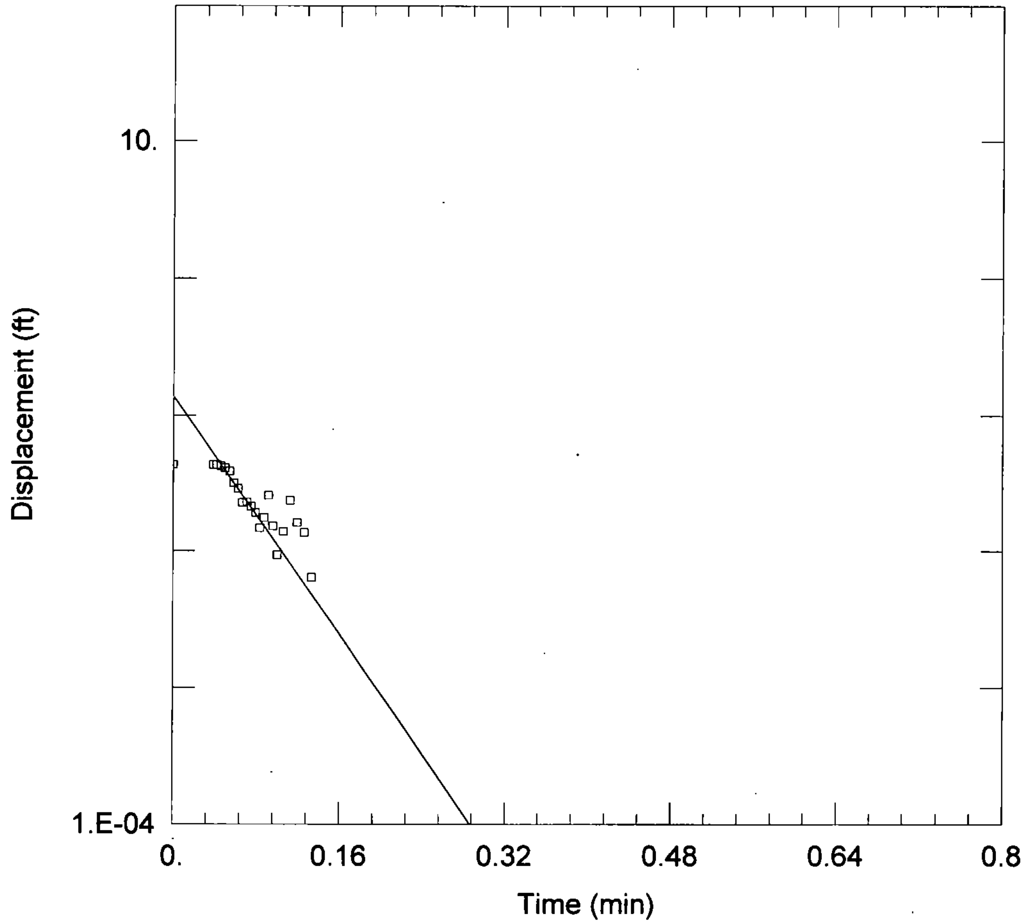
WELL DATA (MW-204S_T2)

Initial Displacement: 0.03982 ft
Wellbore Radius: 0.3333 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3
Casing Radius: 0.08333 ft
Well Skin Radius: 0.3333 ft
Total Well Penetration Depth: 4.38 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.01095 cm/sec
y0 = 0.04 ft



MITTAL - CLARK LANDFILL

Data Set: C:\Documents and Settings\schmidtb\Desktop\Mittal Clark Landfill\MW-204S_3.aqt
Date: 02/24/10 Time: 12:45:15

PROJECT INFORMATION

Company: AECOM
Client: Mittal
Project: 60139029 Task 8000
Test Location: East Chicago, IN
Test Well: MW-204S Test 3
Test Date: 2/12/2010

AQUIFER DATA

Saturated Thickness: 4.38 ft
Anisotropy Ratio (Kz/Kr): 1.

WELL DATA (MW-204S_T3)

Initial Displacement: 0.04349 ft
Wellbore Radius: 0.3333 ft
Screen Length: 10. ft
Gravel Pack Porosity: 0.3
Casing Radius: 0.08333 ft
Well Skin Radius: 0.3333 ft
Total Well Penetration Depth: 4.38 ft

SOLUTION

Aquifer Model: Unconfined
Solution Method: Bouwer-Rice

K = 0.04974 cm/sec
y0 = 0.1361 ft

Appendix F

Slag-fill Laboratory Analytical Reports and Level IV Data Quality Packages (on CD)

Appendix G

Ecological Risk Evaluation

ECOLOGICAL EXCLUSION CRITERIA WORKSHEET

The Exclusion Criteria Worksheet is intended to aid facilities and regulators in determining whether or not further ecological evaluation is necessary at an affected property where a response action is being pursued utilizing the CAS. Exclusion criteria refer to those conditions at an affected property which preclude the need for a formal ecological risk assessment (ERA) because there are incomplete or insignificant ecological exposure pathways due to the nature of the affected property setting and/or the condition of the affected property media. The person completing the worksheet should be familiar with the affected property but need not be a professional scientist in order to respond, although some questions will likely require contacting a wildlife management agency (U.S. Fish and Wildlife Service, etc.). The worksheet is designed for general applicability to all affected property; however, there may be unusual circumstances which require professional judgment in order to determine the need for further ecological evaluation (e.g., cave-dwelling receptors). In these cases, it is strongly encouraged to contact your state regulatory agency for additional guidance before proceeding.

The worksheet consists of three major parts. Part 1, identification of the affected property and background information, Part 2, the actual exclusion criteria and supportive information, and Part 3, a qualitative summary statement and certification of the information submitted. Answers to the worksheet should reflect existing conditions and should not consider future remedial actions at the affected property. Completion of the worksheet should lead to a logical conclusion as to whether further ecological evaluation is warranted. Definitions of terms used in the worksheet are provided and users are encouraged to review these definitions before completing the worksheet

The Exclusion Worksheet has been adapted from and follows the Texas Natural Resources Conservation Commission (TNRCC) Texas Risk Reduction Program (TRIRP) Tier I Checklist. TNRCC has developed some additional information regarding the use of their Tier 1 Checklist which should also be consulted in completing the CAS Ecological Exclusion Criteria Worksheet. This information can be found in Chapter 2 of TNRCCs Guidance for Conducting Ecological Risk Assessments at Remediation Sites in Texas, Draft Final, August 2000;

Part 1. Affected Property Identification and Background Information

1. Provide a description of the specific area of the response action and the nature of the release. Include estimated acreage of the affected property and the facility property, and a description of the type of facility and/or operation associated with the affected property. Also describe the location of the affected property with respect to the facility property boundaries and public roadways.

   Attach available USGS topographic map and/or aerial or other affected property photographs to this form to depict the affected property and surrounding area.

   Topo map _X_ Aerial photo _X_ Other ________

The Clark Landfill, Group B, is located in the north-central portion of the ISG-IH peninsula, located between the iron producing facility and blast furnaces and occupies approximately 43 acres. The Clark Landfill is over a mile from the nearest public roadway and is completely surrounded by heavy industry to a distance of over ½ mile (excluding Lake Michigan). The Clark Landfill is located approximately 1000 feet from Lake Michigan's Indiana Harbor, which is the closest surface water body.

The landfill was constructed over general slag-fill material that was placed in what once was Lake Michigan to create land on which the steel mill could be built. The landfill had been used for over 20 years to dispose of steel manufacturing waste products including, but not limited to; basic oxygen furnace (BOF) dust and slag. The landfill is located adjacent the north edge of an intake flume that conveys plant service water from Lake Michigan to the steel-making complex. Waste disposal at the Clark Landfill ceased in March 1998. The landfill cover was completed in March 2008 and IDEM issued a final closure *certification for the landfill in December 2010. The landfill is instrumented to monitor slope stability and work is being conducted to establish a post-closure groundwater monitoring program.*

Various Figures and Drawings are available for the site. Please refer to following list of figures for general site information:

- *Figure 1-1 - Location Map (depicted on a USGS topographic map)*
- *Figure 1-2 - Site Layout (depicted on an aerial photo of site)*

2. Identify the environmental media known or suspected to contain chemicals of concern (COCs) at the present time. Check all that apply:

Known/Suspected COC Location	Based on sampling data	
_X__ Soil < 5 ft below ground surface	____ Yes	_X__ No
____ Soil> 5 ft below ground surface	____ Yes	____ No
____ Groundwater	____ Yes	_X__ No
____ Surface Water/Sediments	____ Yes	____ No

Explain (previously collected information may be referenced):

The results of the monitoring, testing, analysis, and reporting to ascertain the nature and extent of potential COC at these areas are discussed in the report "Clark Landfill RCRA 3013 Order Investigation Report".

3. Provide the information below for the nearest surface water body which has become or has the potential to become impacted from migrating COCs via surface water runoff, air deposition, groundwater seepage, etc.

   Exclude wastewater treatment facilities and stormwater conveyances/impoundments authorized by permit.

   Also exclude conveyances, decorative ponds, and those portions of the process facilities which are:

   a. Not in contact with surface waters of the State or other surface waters which are ultimately in contact with surface waters of the State; and

   b. Not consistently or routinely utilized as valuable habitat for natural communities including birds, mammals, reptiles, etc.

   The nearest surface water body *~1,000* feet/~~miles~~ from the affected property.

   The surface water body is named: *Indiana Harbor (Lake Michigan), however, the Intake Flume a channel connected to the Indiana Harbor is immediately adjacent to the landfill.*

   The surface water body is best described as a:

   _____ Freshwater stream:

   _____ perennial (has water year round)

   _____ intermittent (dries up completely for at least one week per year)

   _____ intermittent with perennial pools

   _____ Freshwater swamp/marsh/wetland

_____ Saltwater or brackish swamp/marsh/wetland

__X__ Reservoir, lake or pond; approximate surface area: *22,300 square miles*.

______ Drainage ditch

_____ Tidal stream

______ Other (specify)

Is the water body listed as a State classified segment?

______ Yes Segment # Use classification: ______________________

______ No

if the water body is not a State classified segment, identify the first downstream classified segment.

Name:

Segment #:

Use classification

As necessary, provide further description of surface waters in the vicinity of the affected property:

Part 2. Exclusion Criteria and Supportive Information

Subpart A. Surface Water/Sediment Exposure

1) Regarding the affected property where a response action is being pursued, have COCs migrated and resulted in a release or imminent threat of release to either surface waters or to their associated sediments via surface water runoff, air deposition, groundwater seepage, etc.

   Exclude wastewater treatment facilities and stormwater conveyances/impoundments authorized by permit.

   Also exclude conveyances, decorative ponds, and those portions of the process facilities which are:

   a. Not in contact with surface waters of the State or other surface waters which are ultimately in contact with surface waters of the State;

   b. Not consistently or routinely utilized as valuable habitat for natural communities including birds, mammals, reptiles, etc.

   _____Yes __X__No

   Explain:

Based on site observations and collected investigative data, the Clark landfill has not caused a release. The likely migration pathway would be toward the Intake Flume. It should be noted that the water from the Intake Flume under constant pumping by the mill, thus, water flow in the Intake Flume is generally inward toward the pump. A gate has been constructed at the eastern end of the Intake Flume to prevent seiche conditions from causing backflow into the Indiana Harbor.

If the answer is Yes to Subpart A above, the affected property does not meet the exclusion criteria. (However, complete the remainder of Part 2, to determine if there is a complete and/or significant soil exposure pathway, then complete Part 3, Qualitative Summary and Certification).

If the answer is No to Subpart A above, go to Subpart B.

Subpart B. Affected Property Setting

In answering Yes to the following question, it is understood that the affected property is not attractive to wildlife or livestock, including threatened or endangered species (i.e., the affected property does not serve as valuable habitat, foraging area, or refuge for ecological communities). May require consultation with management agencies.

1) Is the affected property wholly contained within contiguous land characterized by: pavement, buildings, landscaped area, functioning cap, roadways, equipment storage area, manufacturing or process area, or other surface cover or structure, or otherwise disturbed ground?

_X_Yes ___No

Explain:

The Clark Landfill is capped with coarse granular material and surrounded by roads, buildings and stockpiles continuously in use for the steel mill operation. Precipitation is collected by the cap's drainage system and routed though the facility's onsite surface water management system.

If the answer is Yes to Subpart B above, the affected property meets the exclusion criteria, assuming the answer to Subpart A was No. (Skip Subparts C and D and complete Part 3, Qualitative Summary and Certification).

If the answer is No to Subpart B above, go to Subpart C.

Subpart C. Soil Exposure *(Skip Subpart C, because Subpart B is Yes)*

1) Are COCs which are in the soil if the affected property solely below the first 5 feet beneath ground surface does the affected property have a physical barrier present to prevent exposure to receptors to COCs in the surface soil?

___Yes ___No

Explain:

If the answer is Yes to Subpart C above, the affected property meets the exclusion criteria, assuming the answer to Subpart A was No. (Skip Subpart D and complete Part 3, Qualitative Summary and Certification).

If the answer is No to Subpart C above, go to Subpart D.

Subpart D. De Minimis Land Area) *(Skip Subpart D, because Subpart B is Yes)*

In answering Yes to the below, it is understood that all of the follow conditions apply:

• The affected property is not known to serve as habitat, foraging area, or refuge to threatened/endangered or otherwise protected species. (Will likely require consultation with wildlife management agencies).

• Similar but unimpacted habitat exists within a half-mile radius.

• The affected property is not know to be located within one-quarter mile of sensitive environmental areas (e.g., rookeries, wildlife management areas, preserves). (Will likely require consultation with wildlife management agencies).

• There is no reason to suspect that the COCs associated with the affected property will migrate such that the affected property will become larger than one acre.

Using human health protective concentration levels as a basis to determine the extent of the COCs, does the affected property consist of one acre or less does it meet all the conditions described above?

___ Yes ___ No

Explain how the conditions are/are not met: ____________________________________

If the answer is Yes to Subpart D, then no further ecological evaluation is needed at the affected property, assuming the answer to Subpart A was No. (Complete Part 3, Qualitative Summary and Certification).

If the answer is No to Subpart D, Proceed to an Ecological Risk Evaluation.

Part 3. Qualitative Summary and Certification (Complete in all cases)

Attach a brief statement (1 page or less) summarizing the information you have provided in this form.

The Clark Landfill, Group B, is located in the north-central portion of the ISG-IH peninsula, located between the iron producing facility and blast furnaces and occupies approximately 43 acres. The Clark Landfill is over a mile from the nearest public roadway and is completely surrounded by heavy industry to a distance of over ½ mile (excluding Lake Michigan). The Clark Landfill is located approximately 1000 feet from Lake Michigan's Indiana Harbor, which is the closest surface water body.

The landfill was constructed over general slag-fill material that was placed in what once was Lake Michigan to create land on which the steel mill could be built. The landfill had been used for over 20 years to dispose of steel manufacturing waste products including, but not limited to, basic oxygen furnace (BOF) dust and slag. The landfill is located adjacent the north edge of an intake flume that conveys plant service water from Lake Michigan to the steel-making complex. Waste disposal at the Clark Landfill ceased in March 1998. The landfill cover was completed in March 2008 and IDEM issued a final closure certification for the landfill in December 2010. The landfill is instrumented to monitor slope stability and work is being conducted to establish a post-closure groundwater monitoring program.

The Clark Landfill is capped with coarse granular material and surrounded by roads, buildings and stockpiles continuously in use for the steel mill operation. Precipitation is collected by the cap's drainage system and routed though the facility's onsite surface water management system. The cap of the landfill limits infiltration of precipitation and based on the nature of the materials contained in the landfill, generation of leachate is not anticipated because the waste does not decompose.

The likely migration pathway is through the groundwater pathway route. However, the cap limits infiltration and the discharge area, although to a surface water body, is a channel from which the water is pumped on a continuous basis for use in facility operations.

Due to the extensive facility operations being conducted daily around the Clark Landfill and based on field observations of the area, the landfill does not appear to be an attractive area for regional air fauna or mammals. The lack of food sources on the landfill, decreases its usefulness to the local wildlife. No wetland soil can be present since the cap is coarse limestone gravel. There is no evidence of a release or in an imminent threat of a release from the Clark Landfill to the Intake Flume or Indiana Harbor (the closest surface water body).

Completed by: ____________________________________ (Typed Name)

____________________________________ (Title)

____________________________________ (Date)

I believe that the information submitted is true, accurate, and complete, to the best of my knowledge.

(Typed Name of Person)

____________________________________ (Title of Person)

____________________________________ (Signature of Person)

____________________________________ (Date Signed)

Appendix H

Groundwater Laboratory Analytical Reports and Level IV Data Quality Packages (on CD)

Appendix H is located on CD attached to Appendix F

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF

DE-9J

OCT 23 2003

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

CT Corporation System
36 S. Pennsylvania Street
Suite 700
Indianapolis, Indiana 46204

RE: Amended RCRA § 3013 Administrative Order
RCRA Docket No.: R3013-5-03-002
ISG Indiana Harbor Inc. and
Tecumseh Redevelopment Inc.

Dear Sir or Madam:

Enclosed is an Amended Administrative Order issued to ISG Indiana Harbor Inc. and Tecumseh Redevelopment Inc. (formerly known as ISG Indiana Harbor Properties Inc.,) by the United States Environmental Protection Agency (U.S. EPA) pursuant to Section (§) 3013 of the Resource Conservation and Recovery Act (RCRA) of 1976, as amended by the Hazardous and Solid Waste Amendments of 1984, U.S.C. § 6934.

The Order requires monitoring, testing, analysis and reporting, in connection with the facility located at 3001 Dickey Road, East Chicago, Indiana. The Order also requires a proposal for such monitoring, testing, analysis and reporting not later than thirty (30) days from the date this Order is issued. ISG may request a conference with U.S. EPA to discuss the Order. Any such conference must be held during the sixty (60) days after the issuance of the Order.

If you have questions concerning this Order, or to schedule a conference, please contact Christine Liszewski at 312/ 886-4670.

Sincerely yours,

for Joseph M. Boyle, Chief
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division

Enclosure

cc: Dale Papajcik Esq, Squires, Sanders & Dempsey
Mike Byron, IDEM
Mike Sickels, IDEM

'03 OCT 24 A9:43

US ENVIRONMENTAL PROTECTION AGENCY
REGION V

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION 5

IN THE MATTER OF:	)	**RCRA Docket No.: R3013-5-03-002**
	)	
ISG Indiana Harbor Inc.	)	
and	)	
Tecumseh Redevelopment Inc.	)	
3001 Dickey Road	)	
East Chicago, Indiana 46312	)	
	)	
	)	
EPA ID No. IND 005 462 601	)	**PROCEEDING UNDER SECTION**
	)	**3013 OF THE RESOURCE**
Respondents.	)	**CONSERVATION AND RECOVERY**
	)	**ACT, 42 U.S.C. § 6934**

'03 OCT 24 A9:42
US ENVIRONMENTAL PROTECTION AGENCY REGION 5
RECEIVED REGIONAL HEARING CLERK

AMENDED ORDER REQUIRING MONITORING, TESTING, ANALYSIS AND REPORTING

I. JURISDICTION

1. This Amended Administrative Order (Order) is issued pursuant to the authority vested in the Administrator of the United States Environmental Protection Agency (EPA) by Section 3013 of the Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 6934 (RCRA). The authority to issue this Order has been delegated to the Regional Administrator by EPA Delegation No. 8-20 dated May 11, 1994, and further delegated to the Chief, Enforcement and Compliance Assurance Branch, Waste Pesticides and Toxics Division, Region 5 (Branch Chief) by Region 5 Delegation No. 8-20, dated April 24, 1996 .

2. This Order is issued to ISG Indiana Harbor Inc. (ISG or Respondent), a corporation organized under the laws of the State of Delaware, and Tecumseh Redevelopment Inc. (Tecumseh or Respondent), a corporation organized under the laws of the State of Delaware and formerly known as ISG Indiana Harbor Properties Inc.

3. On January 31, 1986, the State of Indiana received final authorization pursuant to RCRA Section 3006(b), 42 U.S.C. § 6926(b), to operate a hazardous waste program in lieu of the federal hazardous waste program established under RCRA Subtitle C. Pursuant to the Memorandum of Agreement (MOA) between the State of Indiana and EPA, EPA

expressly retains its rights to issue Orders and bring actions under Section 3013 of RCRA and any other applicable federal statute.

4. This Order is based upon the administrative record compiled by EPA and incorporated herein by reference. The record is available for review by the Respondents and the public at EPA's regional office at 77 West Jackson Boulevard, Chicago, IL 60604.

II. PARTIES BOUND

5. The provisions of this Order shall apply to and be binding upon Respondents and their officers, directors, employees, agents, contractors, successors, and assigns.

6. No change in ownership, corporate, or partnership status relating to the facility described in this Order will in any way alter the status or responsibility of Respondents under this Order. Any conveyance by Respondents of title, easement, or other interest in the facility described herein, or a portion of such interest, shall not affect Respondents' obligations under this Order. Respondents shall be responsible for and liable for any failure to carry out all activities required of Respondents by this Order, irrespective of their use of employees, agents, contractors, or consultants to perform any such tasks.

7. Respondents shall provide a copy of this Order to all contractors, subcontractors, laboratories, and consultants retained to conduct or monitor any portion of the work performed pursuant to this Order within seven (7) calendar days of the effective date of this Order, or on the date of such retention, and Respondents shall condition all such contracts on compliance with the terms of this Order.

8. Any documents transferring ownership and/or operations of the facility described herein from Respondents to a successor-in-interest shall include written notice of this Order. In addition, Respondents shall, no less than thirty (30) days prior to transfer of ownership or operation of the facility, provide written notice of this Order to their successors-in-interest, and written notice of said transfer of ownership and/or operation to EPA.

III. FINDINGS OF FACT

9. ISG and Tecumseh own property at 3001 Dickey Road in East Chicago, Indiana that is currently or was formerly operated as an integrated primary steel manufacturing plant (the facility). The facility occupies over 1200 acres on the southern shore of Lake Michigan. It is bordered on the east by the Indiana Harbor Ship Canal; on the north by Lake Michigan; on the west by Amoco Whiting Refinery; and on the south by open land,

residential property and small industries.

10. The facility has operated since the early 1900s under several different owners and has the capacity to produce iron, raw steel, cast steel, hot strip, cold rolled strip, hot dip galvanized steel and tin and chromium electroplated steels. The facility originally opened in the early 1900s as the Marks Steel Company. Subsequently, Youngstown Sheet and Tube Company, Jones & Laughlin Steel Corporation (Jones & Laughlin) and LTV Steel Company, Inc. (LTV Steel) owned and operated the plant. ISG acquired most of the property comprising the facility from LTV Steel on April 12, 2002. The remaining portion of the facility was acquired by ISG Indiana Harbor Properties Inc. on April 12, 2002. ISG Indiana Harbor Properties Inc. was re-named Tecumseh Redevelopment Inc. in a amendment to its Certificate of Incorporation dated April 14, 2003.

11. Pursuant to Section 3010 of RCRA, 42 U.S.C. § 6930, on or about August 15, 1980, Jones and Laughlin notified EPA that it generated and treated, stored or disposed of hazardous waste at the facility.[1] On its notification of hazardous waste activity form (EPA Form 8700-12), Jones & Laughlin identified the hazardous wastes that it handled as F016, K062 and K087.

12. Pursuant to Section 3005(e) of RCRA, 42 U.S.C. § 6925(e), on or about November 14, 1980, Jones & Laughlin submitted to EPA a Part A Hazardous Waste Permit Application to treat, store or dispose of hazardous waste at the facility. In the Part A application, Jones & Laughlin stated that it stored K062 and D007 hazardous waste in tanks and treated F006 waste in its Central Wastewater Treatment Plant.

13. Hazardous Waste No. K062 consists of spent pickle liquor generated by steel finishing operations of facilities within the iron and steel industry. See 40 C.F.R. § 261.32. The hazardous constituents found in K062 are hexavalent chromium and lead. See Appendix

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[1] EPA first promulgated regulations on May 19, 1980 (45 Fed. Reg. 33073), for the identification and listing of wastes that are regulated under RCRA as hazardous wastes for purposes of 40 C.F.R. Parts 262 through 265, 268, 270, 271, and 124 (regulatory hazardous wastes). Regulatory hazardous wastes include wastes that are designated by waste codes beginning with the letters D, F, K, P and U. Waste codes D000 through D003 are described in 40 C.F.R. §§ 261.21 through 261.23. Waste codes D004 through D043 are described in 40 C.F.R. § 261.24. Wastes codes beginning with "F" are listed and described in 40 C.F.R. § 261.31. Waste codes beginning with "K" are listed and described in 40 C.F.R. § 261.32. Waste codes beginning with "P"and waste codes beginning with "U" are listed and described in 40 C.F.R. § 261.33.

The scope of RCRA § 3013 extends not only to such regulatory hazardous wastes, but also to wastes that are hazardous wastes pursuant to RCRA § 1004(5), even though they might not be regulatory hazardous wastes. See 40 C.F.R. § 261.1(b)(1).

VII to 40 C.F.R. Part 261.

14. Hazardous Waste No. K087 consists of decanter tank tar sludge from coking operations. See 40 C.F.R. § 261.32. The hazardous constituents found in K087 are phenol and naphthalene. See Appendix VII to 40 C.F.R. Part 261.

15. Hazardous Waste No. D007 is chromium. See 40 C.F.R. § 261.24, Table 1.

16. Hazardous Waste No. F006 consists of wastewater treatment sludges from electroplating operations. The hazardous constituents found in F006 are cadmium, hexavalent chromium, nickel and cyanide (complexed). See Appendix VII to 40 C.F.R. Part 261.

17. In letters dated May 17, 1985 and October 31, 1985, LTV Steel notified EPA and the Indiana State Board of Health that it intended to withdraw its Part A Hazardous Waste Permit Application because one storage tank was excluded from RCRA permit requirements under 40 C.F.R. § 261.2(e)(ii) and the other storage tanks were no longer used to store hazardous waste for 90 days or longer and thus did not require a RCRA permit. In addition, LTV Steel determined that no RCRA permit was needed for the wastewater treatment plant pursuant to the exclusion for wastewater treatment units at 40 C.F.R. § 270.1(c)(2)(v).

18. The Indiana Department of Environmental Management (IDEM) conducted a RCRA Facility Assessment (RFA) of the facility in1992. The objectives of the RFA were: 1) to identify all solid waste management units (SWMUs) and Areas of Concern (AOCs) at the facility; 2) to assess the potential for release of hazardous waste or hazardous constituents from each SWMU and AOC; 3) to determine what further measures, if any, should be taken to safeguard human health and the environment from a release; and 4) to obtain a thorough understanding of past and present waste management practices. IDEM identified 81 SWMUs and 5 AOCs at the facility. Results of the RFA are documented in a RFA Report dated September 30, 1993. A list of the SWMUs and AOCs identified by IDEM is provided as Table I-1 and Table I-2, respectively, to this Order.

19. A SWMU is defined as any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely and systematically released. See 55 Fed. Reg. 30808 (July 27, 1990); 61 Fed. Reg. 19442 (May 1, 1996). An AOC is defined as any area of the facility under the control or ownership of the owner or operator where a release to the environment of hazardous waste(s) or hazardous constituents has occurred, is suspected to have occurred, or may occur, regardless of the frequency or duration of the release.

20. Of the 81 SWMUs and 5 AOCs identified in the RFA, IDEM identified 34 SWMUs and 3 AOCs as having a high potential for release of hazardous waste or hazardous

constituents and requiring further investigation. Based upon review of the information in the RFA and evaluation of additional information regarding conditions at the facility, EPA has concluded that the SWMUs and AOC described below require further investigation.

SWMU # 1 - Blast Furnace Filter Cake Pile

21. SWMU #1 consists of Blast Furnace Filter Cake Pile which sits directly on the ground in a semi-enclosed area with no roof located at the northern corner of the Sinter Plant. The blast furnace wastewater treatment plant treats blast furnace scrubber waters and uses a vacuum drum filter to remove solids as a filter cake. The Blast Furnace Filter Cake Pile is an active unit from which filter cake is removed on a routine basis and processed for reuse as raw material feedstock in the Sinter Plant. Analytical results of samples of the Blast Furnace Filter Cake collected by LTV Steel from 1994 through 2000 show the presence of, among other things, nickel, barium, chromium, lead, arsenic, and cadmium. The release potential to the surrounding soils, groundwater and surface water is high because the unit has no release controls. This SWMU is located on property owned by ISG.

SWMU # 7 - "The Hill"

22. SWMU #7, also known as "The Hill," is a landfill used for disposal of solid waste located northeast of the Terminal Lagoon. In a November 9, 2001 report prepared for EPA, LTV Steel stated that use of this unit was terminated in August 1989 and that this landfill was used to manage wastes similar to those placed in the Clark Landfill. Wastes placed in the Clark Landfill include BOF precipitator dust, terminal lagoon sludge, reladle/desulfurization dust, tandem mill (6-Stand) oily sludge, caster scale pit sludge, roll shop wastes, ladle metallurgical facility (LMF) baghouse dust and general mill clean-up material. Analytical result show that these wastes contain, among other things, barium, cadmium, chromium, lead, and phenols. <u>See</u> paragraphs 26 through 29 below. This unit has no release controls. The lack of release controls and the nature of the waste managed indicate a high release potential to the soil, groundwater and surface water. This SWMU is located on property owned by ISG.

SWMU # 8 - The Terminal Lagoon

23. SWMU #8 is a large water treatment lagoon containing process water from the Blast Furnaces, Sinter Plant, Basic Oxygen Furnaces (BOF) and Powerhouse. It is an active unit. Data submitted by LTV Steel to IDEM on March 28, 1991 in its renewal application for a National Pollutant Discharge Elimination System (NPDES) permit show that discharges to the Terminal Lagoon contain, among other things, lead, cyanide and phenols. Analytical results of sludge samples collected by LTV Steel in 1987 and 1989 from Terminal Lagoon show the presence of, among other things, arsenic, barium,

cadmium, chromium, and lead. The release potential to soil, groundwater and surface water is high because this unit has no release controls. This SWMU is located on property owned by ISG.

SWMU #9 - Terminal Lagoon Oil Skimmer Tank

24. SWMU #9 is an oil skimmer tank that is part of an old oil separation system associated with the Terminal Lagoon (SWMU #8). It is located on the southwest side of the Terminal Lagoon. The tank appears to be an old railroad tank car. The tank's seams are riveted, rather than welded. As stated above, discharges to the Terminal Lagoon contain, among other things, lead, cyanide and phenols. Analytical results of sludge samples collected by LTV Steel in 1987 and 1989 from Terminal Lagoon show the presence of, among other things, arsenic, barium, cadmium, chromium, and lead. The release potential to soil and groundwater is moderate to high because this unit has no secondary containment system and sits over bare ground. This SWMU is located on property owned by ISG.

SWMU #10 - Terminal Lagoon Sludge Pit

25. SWMU #10 is the Terminal Lagoon Sludge Pit which is an unlined oily sludge dewatering pit that was used to manage oily wastewater treatment sludge. It was located on the north side of the Terminal Lagoon. In a November 9, 2001 report to EPA, LTV Steel stated that all sludge was removed from this unit and disposed of in the Clark Landfill or off-site. As stated above, discharges to the Terminal Lagoon contain, among other things, lead, cyanide and phenols. Analytical results of sludge samples collected by LTV Steel in 1987 and 1989 from Terminal Lagoon show the presence of, among other things, arsenic, barium, cadmium, chromium, and lead. The release potential to soil and groundwater is high because there were no release controls associated with this unit. This SWMU is located on property owned by ISG.

SWMU #20 - Clark Landfill

26. SWMU # 20 is the Clark Landfill which is located in the north central section of the facility and is approximately 43 acres in size. Waste materials disposed of at this landfill include BOF precipitator dust, terminal lagoon sludge, reladle/desulfurization dust, tandem mill (6-Stand) oily sludge, caster scale pit sludge, roll shop wastes, LMF baghouse dust and general mill clean-up material. This SWMU is located on property owned by ISG.

27. Analytical results of samples collected by LTV Steel of BOF precipitator dust from1986 through 1989 show that this waste contains, among other things, barium, cadmium, chromium, lead, and phenols. Analytical results of sludge samples from Terminal Lagoon collected by LTV Steel in 1987 and 1989 show the presence of, among other

things, arsenic, barium, cadmium, chromium, and lead. Analytical results of samples from reladle/desulfurization baghouse dust collected by LTV Steel in1987 and 1989 show the presence of, among other things, barium, cadmium, chromium, and lead. Analytical results of samples from tandem mill (6- Stand) oily sludge collected by LTV Steel in1986 and 1989 show the presence of, among other things, arsenic, barium, lead, and phenols. Analytical results of samples from caster scale pit sludge collected by LTV Steel in1987 and 1989 show the presence of, among other things, barium, cadmium, and chromium. Analytical results of samples from LMF baghouse dust collected by LTV Steel in1988 and 1989 show the presence of, among other things, phenols, cyanide, barium, cadmium, chromium and lead.

28. Analytical results of samples collected by LTV Steel of roll shop wastes in 1989 show the presence of, among other things, cadmium, chromium, and lead. Two of the samples of roll shop waste collected in 1989 exceeded the regulatory level for toxicity for chromium established by EPA in Table 1 of 40 C.F.R. § 261.24. In addition, one sample collected by LTV Steel in 1991, two samples collected in 1993, two samples collected in 1996 and one sample collected in 1997 exceeded the regulatory level for chromium.

29. On September 17 and 18, 1996, PRC Environmental Management, Inc., an EPA contractor, collected 13 samples of roll-shop waste from the facility. These samples were analyzed by EPA. At least four of the samples contained chromium in concentrations above the 5mg/l regulatory level established at 40 C.F. R 261.24.

30. On August 6, 1997, the foundation underlying the Clark Landfill failed and a portion of the toe of the landfill foundation moved both horizontally and vertically into LTV Steel's water intake flume. The movement of the landfill foundation allowed a portion of the landfill itself to drop into the void left by the moving foundation. As a result, LTV Steel estimated that between 11,000 and 18,000 cubic yards of landfill is now below the water table. LTV Steel did not conduct chemical testing to determine the impact of the landfill failure on the groundwater or water intake flume.

31. LTV Steel submitted an application for an interim solid waste (non-hazardous waste) permit for the Clark Landfill to IDEM on August 29, 1989. IDEM did not issue a solid waste permit for the landfill. In a May 20, 1996 letter to IDEM, LTV Steel stated that it intended to discontinue the use of the landfill after May 1998 and withdrew its application for a solid waste permit.

32. Waste disposal at the Clark Landfill ceased in March 1998. LTV Steel submitted an amended permit application for closure of the Clark Landfill as a non-hazardous landfill to IDEM on July 30, 1999. The permit application includes, among other things, a ground water sampling and analysis plan for four monitoring wells, a closure plan and a post-closure plan.

SWMU #23 - Filter Backwash Pile Site

33. SWMU #23 is the Filter Backwash Pile Site consisting of a pile of wastewater treatment sludge sitting outside, directly on the ground, on the north side of the 84-inch Hot Strip Mill. In a November 9, 2001 report prepared for EPA, LTV Steel stated that the Filter Backwash Pile Site has been eliminated or closed. Analytical results of samples of the 84-inch wastewater treatment filter backwash collected by LTV Steel from 1994 through 2000 show the presence of, among other things, nickel, barium, cadmium, chromium, lead, creosol and phenol. The release potential to soil and groundwater is high because there are no release controls associated with this unit. This SWMU is located on property owned by ISG.

SWMU # 24 - North Lagoon

34. SWMU #24 is the North Lagoon, which has a surface area of approximately 13 acres and is located directly adjacent to Lake Michigan at the northern tip of the facility. The North Lagoon receives treated process water from the 84-inch Hot Strip Mill and the No. 3 Cold Reduction Sheet Mill, as well as storm water drainage from the facility. Data submitted by LTV Steel to IDEM on March 28, 1991 in its renewal application for a NPDES permit show that discharges to the North Lagoon contain, among other things, barium, lead and nickel. Analytical results of sediment samples from the North Lagoon collected by LTV Steel in 1999 show the presence of, among other things, chromium, lead, phenols, barium and nickel. There are no release controls associated with this unit and the release potential to soil, groundwater and surface water is high. This SWMU is located on property owned by ISG.

SWMU #26 - Old Oily Sludge Pit

35. SWMU #26 is the Old Oil Sludge Pit that was used as a wastewater treatment sludge dewatering pit. It was located on the south side of the North Lagoon. In a November 9, 2001 report prepared for EPA, LTV Steel stated that this site has been eliminated or closed. Release potential to soil, groundwater and surface water is high because there are no release controls associated with this unit. This SWMU is located on property owned by ISG.

SWMU #47 - Wastewater Treatment Sludge Pile Site

36. SWMU #47 is the Wastewater Treatment Sludge Pile Site that was used to manage wastewater treatment sludge (D006 and possibly F006). It was located outside, directly on the ground, northeast of the Central Treatment Plant. In a November 9, 2001 report prepared for EPA, LTV Steel stated that this sludge pile was eliminated or closed. EPA Hazardous Waste No. D006 is cadmium. As stated above, the hazardous constituents found in F006 are cadmium, hexavalent chromium, nickel and cyanide (complexed). See

Appendix VII to 40 C.F.R. Part 261. The release potential to soil, groundwater and surface water is high because the unit has no release controls. This SWMU is located on property owned by Tecumseh.

SWMU #65 - Coke Plant Decanter Site

37. SWMU #65 is the Coke Plant Decanter site that was formerly used for coking operations. It is located adjacent to the Indiana Harbor Shipping Canal. Decanter tar sludge (K087) from coking operations was managed in tanks at this site. As stated above, the hazardous constituents found in K087 are phenol and naphthalene. See Appendix VII to 40 C.F.R. Part 261. On July 11 and 12, 2000, TechLaw, Inc., an EPA contractor, collected samples from, among other things, the Coke Plant Decanter Site. These samples were analyzed by EPA. Analytical results of groundwater samples collected from this site show the presence of hazardous constituents including phenol, naphthalene, pyrene, fluorene and several other organic compounds. Split samples of the groundwater analyzed by LTV Steel show the presence of barium, cadmium, chromium, lead, silver, acenaphthene and napthalene. The release potential to groundwater and soil at this site is very high as documented by the results of groundwater samples. This SWMU is located on property owned by Tecumseh.

SWMU #67 - Sinter Plant

38. SWMU #67 is the Sinter Plant at which flue dust from the H3 and H4 blast furnaces and blast furnace wastewater treatment plant recycle sludge, among other things, are fused into a porous mass for charging into the blast furnace. During the RFA, an IDEM inspector observed spillage all around the plant. Analytical results of samples of the blast furnace wastewater treatment plant sludge collected by LTV Steel in 1997 show the presence of, among other things, nickel, barium, cadmium, chromium, lead, and arsenic. Analytical results of samples of the H3/H4 flue dust collected by LTV Steel in 1997 show the presence of, among other things, nickel, barium, chromium, and lead. The release potential to soil and groundwater is high because of the spillage visible all around the plant. This SWMU is located on property owned by ISG.

SWMU #68 - Sinter Plant Feedstock Piles

39. SWMU #68 is the Sinter Plant Feedstock Piles which consist of several huge feedstock piles which sit outside, directly on the ground. In a November 9, 2001 report prepared for EPA, LTV Steel stated that the feedstock is primarily flue dust from the H3 and H4 blast furnaces and blast furnace wastewater treatment plant recycle sludge. As stated above, analytical results of samples of the blast furnace wastewater treatment plant sludge collected by LTV Steel in 1997 show the presence of, among other things, nickel, barium, cadmium, chromium, lead, and arsenic. Analytical results of samples of the H3/H4 flue dust collected by LTV Steel in 1997 show the presence of, among other things, nickel,

barium, chromium, and lead. The release potential to soil and groundwater is high because the unit has no release controls. This SWMU is located on property owned by ISG.

<u>SWMU #73 - Old Quenching Area</u>

40. SWMU #73 is the Old Quenching Area located in the Heckett operation area next to the west bridge. Spent pickle liquor (K062) from the basic oxygen furnace was poured out of tankers onto piles for the purpose of quenching hot slag materials. As stated above, the hazardous constituents found in K062 are hexavalent chromium and lead. <u>See</u> Appendix VII to 40 C.F.R. Part 261. There are no release controls associated with this unit and the release potential to surface water, soil and groundwater is high. This SWMU is located on property owned by ISG.

<u>Area of Concern (Former Coking Area)</u>

41. This is the former coking area east of the facility designated on a facility map provided by LTV Steel to IDEM as Coke Plant #1. The area may have been used to manage decanter tar sludge. As stated above, the hazardous constituents found in decanter tar sludge (K087) are phenol and naphthalene. <u>See</u> Appendix VII to 40 C.F.R. Part 261. This area is now covered with vegetation. Land areas surrounding coking operations are usually highly contaminated. Therefore, release potential to soil and groundwater is high. This area is not identified in the September 30, 1993 RFA Report prepared by IDEM. It was identified on a facility map LTV Steel provided to IDEM after IDEM prepared the RFA Report. This SWMU is located on property owned by Tecumseh.

<u>Effects on Human Health or the Environment</u>

42. The following are effects on human health or the environment that may be caused by the constituents described above:

   A. Acenaphthene: Acenaphthene can cause liver and kidney damage at high levels.

   B. Arsenic: Arsenic is a known carcinogen, and a potential teratogenic agent. Its main path of exposure to humans is through inhalation and dermal absorption. Long term exposure can cause nerve and liver damage, narrowing of the blood vessels, and affect red blood cell production. Arsenic in the presence of acid may release a deadly gas, arsine. Arsenic has high acute toxicity to aquatic life, birds and land animals. It has a low solubility in water and is persistent in water, with a half-life of 200 days. Arsenic has high chronic toxicity to aquatic life, and is known to bioaccumulate in fish tissues.

C. Barium: Barium's route of exposure is generally through ingestion and inhalation. Barium compounds that dissolve well in water cause the most harmful health effects. Acute high exposure through ingestion result in liver, kidney, and heart damage. EPA allows 2 parts per million (ppm) of barium in drinking water. Barium's solubility varies from high to moderate depending on the barium salt. It is highly persistent in water and has a half-life of greater than 200 days.

D. Cadmium: High exposure to cadmium can cause acute health effects such as severe lung damage, fluid in the lungs, and in severe cases death. Cadmium is a probable cancer causing agent in humans, some studies link it to kidney and prostate cancer in humans, and it has been shown to cause lung and testes cancer in animals. It is a probable teratogen in humans, and may also damage the testes and affect the female reproductive cycle. Repeated low exposure can cause permanent kidney damage. Cadmium is highly persistent in water, with a half-life of greater than 200 days. Cadmium toxicity is influenced by water hardness, the harder the water the lower the toxicity. It has chronic and acute toxicity to aquatic life.

E. Chromium: Acute exposure to chromium dust can cause "metal fume fever", which causes fevers, chills, and muscle aches. Chromium is highly persistent in water and has a half-life of greater than 200 days. Hexavalent chromium is soluble and more mobile in groundwater than the trivalent chromium. Hexavalent chromium has a high acute and chronic toxicity to aquatic life.

F. Creosol: When creosols are breathed, ingested or applied to the skin at very high levels, effects observed in people include irritation and burning of skin, eyes, mouth and throat; abdominal pain and vomiting; heart damage; anemia; liver and kidney damage; facial paralysis; and coma. U.S. EPA has determined that creosols are possible human carcinogens.

G. Cyanide: Exposure to high levels in the air for a short time harms the brain and heart and may cause coma and death. Low level exposure may result in breathing difficulties, heart pains, vomiting, blood changes, headaches and enlargement of the thyroid gland.

H. Lead: Lead is a probable teratogen in humans. The primary routes of exposure are through inhalation and ingestion. Chronic health effects include decreased fertility in male and females; kidney and brain damage. Chronic lead exposure causes nerve and behavioral effects in humans and could cause similar effects in birds and animals. Water hardness controls the toxicity of lead to aquatic life, the softer the water the greater the toxicity. It has a high chronic toxicity to aquatic life.

I. Nickel: The most common adverse health effect in humans is an allergic reaction. Lung effects, include chronic bronchitis and reduced lung function. The U.S. Department of Health and Human Services has determined that nickel and certain nickel compound may reasonably be anticipated to be carcinogens.

J. Naphthalene: Very high levels of naphthalene can cause hemolytic anemia and damage the kidneys, liver and eyes. Naphthalene has moderate acute and chronic toxicity to aquatic life.

K. Phenol: Skin exposure to high levels causes liver damage, diarrhea and hemolytic anemia.

L. Pyrene: Adverse health effects have been observed in the central nervous system, liver, kidneys, skin and gastrointestinal system. Very high concentrations may cause narcosis.

M. Silver: Exposure to high levels results in breathing problems, lung and throat irritation and stomach pains. Long term exposure causes a condition called arygria, a blue-gray discoloration of the skin and other body tissues.

IV. CONCLUSIONS OF LAW

43. Respondents' facility is a "facility or site" within the meaning of Section 3013(a) of RCRA, 42 U.S.C. § 6934(a).

44. Respondents are "persons" as defined in Section 1004(15) of RCRA, 42 U.S.C. § 6903(15).

45. Each Respondent is an "owner" and "operator" of portions of the facility within the meaning of Section 3013(a) of RCRA, 42 U.S.C. § 6934(a).

46. Section 1004(27) of RCRA, 42 U.S.C. § 6905(27) defines the term "solid waste" to mean "any garbage, refuse . . . and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations . . ."

47. Section 1004(5) of RCRA, 42 U.S.C. § 6903(5), defines the term "hazardous waste" to mean:

> a solid waste, or combination of solid wastes, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may-
>
> > (A) cause or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness; or
> >
> > (B) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed.

48. Section 1004(3) of RCRA, 42 U.S.C. § 6903(3), defines the term "disposal" to mean "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters."

V. FINDING OF SUBSTANTIAL HAZARD

Upon the basis of the foregoing Findings of Fact, and pursuant to Section 3013(a) of RCRA, 42 U.S.C. § 6934(a), EPA makes the following determinations:

49. Hazardous wastes within the meaning of Section 1004(5) of RCRA, 42 U.S.C. § 6903(5), are present at the facility and were treated, stored or disposed there.

50. The presence of hazardous wastes at the facility and/or the release of hazardous wastes from the facility may present a substantial hazard to human health or the environment.

51. The actions required by this Order are reasonable to ascertain the nature and extent of such hazard.

VI. ORDER

52. Based on the Findings of Fact, Conclusions of Law and Findings of Substantial Hazard as set forth above, each Respondent is hereby ordered, pursuant to Section 3013 of RCRA, 42 U.S.C. § 6934, to submit three (3) copies of a written proposal to EPA within thirty (30) days from the issuance of this Order, for carrying out monitoring, testing, analysis,

and reporting in order to ascertain the nature and extent of the hazard posed by the hazardous wastes that are present at or that may have been released from the portions of the facility owned and operated by each Respondent. Each Respondent is hereby ordered to implement such proposal once approved, or modified and approved, by EPA. All work undertaken pursuant to this Order shall be performed in a manner consistent with EPA Region 5's Environmental Investigations Standard Operating Procedures and Quality Assurance Manual. Such written proposal shall be specific and shall include, but is not limited to, the following:

A. A soil sampling and analysis work plan, including schedule and proposal for progress reports, to collect and analyze representative soil samples to determine the nature and extent of any soil contamination in and around all of the SWMUs and AOC identified above. The plan shall include the number, location, depth of samples, the parameters of the analyses, and quality assurance measures.

B. A sediment sampling and analysis work plan, including schedule and proposal for progress reports, to collect and analyze representative sediment samples to determine the nature and extent of contamination in sediments in SWMUs #8 and #24. The plan shall include the number, location, depth of samples, the parameters of the analyses, and quality assurance measures.

C. A work plan, including schedule and proposal for progress reports, to evaluate (based on field data, tests, and cores) the hydrogeologic conditions at the facility, including the determination and description of: (i) hydrogeologic cross-sections showing the extent of hydrogeologic units in the vicinity of the facility; (ii) horizontal and vertical conductivities, permeabilities, and porosities of the aquifers in the vicinity of the facility and the nature of the hydraulic interconnections and aquitards, or barriers; (iii) the water level contour and/or potentiometric maps; and (iv) the direction and velocity of groundwater flow, and seasonal variations, in the uppermost water-bearing zones in the area likely to be affected by migration of hazardous wastes from the facility. The plan shall consider means to determine areas of discharge and recharge of groundwater in the areas likely to be affected by migration of hazardous wastes from the facility.

D. A groundwater sampling and analysis work plan, including schedule and proposal for progress reports, to characterize the groundwater quality and the extent of any groundwater contamination, both vertically and horizontally, which may exist in, around or on account of the SWMUs and AOC identified above. The plan shall include the number, location and frequency of samples to be taken, the analysis parameters, and quality assurance measures.

53. Each work plan above shall be designed to define the nature, location, extent, direction and rate of movement of any hazardous wastes or hazardous waste constituents which are

present at or have been released from the facility. Each work plan shall document the procedures the Respondent shall use to conduct the investigations necessary: (1) to characterize the potential pathways of migration of hazardous waste and hazardous waste constituents; (2) characterize the sources of hazardous waste and/or hazardous waste constituent contamination; (3) define the degree and extent of hazardous waste and/or hazardous constituent contamination; and (4) identify actual or potential receptors.

54. Respondents shall insure that laboratories used by Respondents for analyses perform such analyses according to the EPA methods included in "Test Methods for Evaluating Solid Waste" (SW-846) or other methods deemed satisfactory to EPA. If methods other than EPA methods are to be proposed, Respondents shall submit all protocols to be used for analysis to EPA at least 30 calendar days prior to the commencement of the analyses. Respondents shall also ensure that laboratories used by Respondents for analyses participate in a quality assurance/quality control program equivalent to that which is followed by EPA.

55. Based on work performed under the work plans described above, EPA may determine that additional investigation, analysis, and/or reporting is necessary to meet the purposes of this Order. If EPA determines that Respondent(s) shall perform additional work, EPA will notify Respondent(s) in writing and specify the basis for its determination that additional work is necessary. Within fifteen (15) days after the receipt of such determination, Respondent(s) shall have the opportunity to meet or confer with EPA to discuss the additional work. If required by EPA, Respondent(s) shall submit for EPA approval a work plan for the additional work. EPA will specify the contents of such work plan. Such work plan shall be submitted by Respondent(s) within thirty (30) days of receipt of EPA's determination that additional work is necessary, or according to an alternative schedule established by EPA.

56. The written proposal and all reports or documents required to be submitted under this Order shall be mailed to:

Jonathan Adenuga, Project Coordinator
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, IL 60604

VII. SUBMISSIONS / AGENCY REVIEW

57. EPA will review all plans, reports, or other submittals required under this Order. EPA may: (a) approve the submission; (b) approve the submission with modifications; (c) disapprove the submission and direct Respondent(s) to re-submit the document after

incorporating EPA's comments; or (d) disapprove the submission and assume responsibility for performing all or any part of the work. As used in this Order, the terms "approval by EPA," "EPA approval," or a similar term means the action described in (a) or (b) of this paragraph.

58. Prior to approval in writing, or approval with modifications in writing, no plan, report, or other submittal shall be construed as approved and final. Oral advice, suggestions, or comments given by EPA representatives will not constitute approval, nor shall any oral approval or oral assurance of approval be considered as binding.

59. Upon receipt of a notice of disapproval in paragraph 57(c) above or a request for a modification, Respondent(s) shall, within fifteen (15) days, or such longer time as specified by EPA in its notice of disapproval or request for modification, correct the deficiencies and resubmit the plan, report, schedule, other item for approval. Notwithstanding the notice of disapproval, or approval with modifications, Respondent(s) shall proceed, at the direction of EPA, to take any action required by any non-deficient portion of the submission.

60. Within ten (10) days following EPA approval, or approval with modifications, of a plan, the Respondent shall implement the approved document.

61. All plans, reports, and/or other submittals required by this Order are, upon approval or approval with modifications by EPA, incorporated into this Order as if fully set forth in text herein. Any noncompliance with such EPA-approved plans, reports, specifications, schedules, and attachments shall be noncompliance with this Order. Oral advice or approvals given by EPA representatives shall not relieve Respondents of their obligations to obtain any formal, written approvals required by this Order.

62. In all instances which this Order requires written submissions to EPA, each submission must be accompanied by the following certification signed by a "responsible official":

> I certify that the information contained in or accompanying this submission is true, accurate, and complete.

For the purpose of this certification, a "responsible official" means person in charge of a principal facility function, or any other person who performs similar decision-making functions for the facility.

VIII. PROJECT COORDINATORS

63. EPA hereby designates as its Project Coordinator:

Jonathan Adenuga
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, IL 60604

64. Within ten (10) calendar days of receipt of this Order, each Respondent shall designate a Project Coordinator and submit the designated Project Coordinator's name, address, and telephone number in writing to EPA.

65. Each Project Coordinator shall, on behalf of the party that designated that Project Coordinator, oversee the implementation of this Order and function as the principal project contact.

66. Respondents shall provide EPA with a written notice of any change in their Project Coordinators. Such notice shall be provided at least seven (7) calendar days prior to the change in Project Coordinator.

IX. THREATS TO PUBLIC HEALTH OR THE ENVIRONMENT

67. If EPA's Project Coordinator determines that activities in compliance or noncompliance with this Order have caused or may cause a release of hazardous waste or waste constituents, or a threat to the public health or to the environment, EPA may require that the Respondent(s) stop further implementation of this Order for such a period of time as may be needed to abate any such release or threat and/or undertake any action which EPA determines is necessary to abate such release or threat; and may require Respondent(s) to resume implementation of this Order.

X. SAMPLING AND DOCUMENT AVAILABILITY

68. The Respondents shall submit to EPA upon request, the results of all sampling and/or tests or other data generated by, or on behalf of, the Respondents in implementing the requirements of this Order.

XI. ACCESS

69. Respondents shall provide access at all reasonable times to the facility and facility

property and to all records and documentation relating to conditions at the facility and the activities conducted pursuant to this Order to EPA and its employees, contractors, agents, consultants, and representatives. These individuals shall be permitted to move freely at the facility in order to conduct activities which EPA determines to be necessary.

70. To the extent that activities required by this Order, or by any approved work plans prepared pursuant hereto, must be done on property not owned or controlled by Respondents, Respondents will use their best efforts to obtain site access agreements in a timely manner from the present owners of such property. Best efforts as use in this paragraph shall include the payment of reasonable compensation in consideration of granting access. Respondents shall ensure that EPA's Project Coordinator has a copy of any access agreements.

71. Nothing in this Order limits or otherwise affects EPA's right of access and entry pursuant to applicable law, including RCRA and CERCLA.

72. Respondents shall notify EPA in writing at least ten (10) calendar days before engaging in any field activities, including but not limited to sampling, well-drilling, and installation of equipment. At the request of EPA, Respondents shall provide or allow EPA or its authorized representatives to take split and/or duplicate samples of all samples collected by Respondents pursuant to this Order.

XII. RECORD PRESERVATION

73. Respondents shall retain, during the pendency of this Order and for a minimum of five (5) years after its termination, a copy of all data, records, and documents now in its possession or control, or in the possession or control of their contractors, subcontractors, representatives, or which come into the possession or control of the Respondents, their contractors, subcontractors, or representatives, which relate in any way to this Order. Respondents shall notify EPA, in writing, at least ninety (90) days in advance of the destruction of any such records, and shall provide EPA with the opportunity to take possession of any such records. Such written notification shall reference the caption, docket number and date of issuance of this Order and shall be addressed to:

Chief
Enforcement and Compliance Assurance Branch
Waste, Pesticides and Toxics Division
EPA Region 5
77 West Jackson Boulevard
Chicago, IL 60604

In addition, Respondents shall provide data, records and documents retained under this Section at any time before the expiration of the five year period at the written request of EPA.

XIII. INFORMATION SUBMITTED TO EPA

74. Any information that Respondents are required to provide or maintain pursuant to this Order is not subject to the Paperwork Reduction Act of 1995, 44 U.S.C. § 3501 et seq.

75. Respondents may assert a business confidentiality claim in the manner described in 40 CFR § 2.203(b) covering all or part of any information submitted to EPA pursuant to this Order. Any assertion of confidentiality shall be adequately substantiated by Respondents when the assertion is made in accordance with 40 CFR § 2.204(e)(4). Information submitted for which Respondents have asserted a claim of confidentiality as specified above shall be disclosed by EPA only to the extent and manner permitted by 40 CFR Part 2, Subpart B. If no such confidentiality claim accompanies the information when it is submitted to EPA, it may be made available to the public by EPA without further notice to the Respondents.

XIV. RESERVATION OF RIGHTS

76. EPA expressly reserves all rights and defenses that it may have, including the right to disapprove of work performed by Respondents pursuant to this Order.

77. EPA expressly reserves all statutory and regulatory powers, authorities, rights, remedies, both legal and equitable, including any which may pertain to Respondents' failure to comply with any of the requirements of this Order, specifically including, without limitation, the right to commence a civil action against Respondents seeking an order requiring compliance with this Order and/or the assessment of penalties under § 3013(e) of RCRA, 42 U.S.C. § 6934(e), and all rights EPA has pursuant to RCRA § 3013(d) to conduct monitoring, testing, analysis at the facility and to seek reimbursement from Respondents for the costs of such activity. This Order shall not be construed as a covenant not to sue, or as a release, waiver or limitation of any rights, remedies, defenses, powers and/or authorities, civil or criminal, which EPA has under RCRA, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the Safe Drinking Water Act (SDWA), the Clean Air Act (CAA), or any other statutory, regulatory, or common law enforcement authority of the United States.

78. EPA expressly reserves all rights and defenses that it may have, including the right both

to disapprove of work performed by Respondents pursuant to this Order, and to order that Respondents perform additional tasks.

XV. OTHER APPLICABLE LAWS

79. All actions required to be taken pursuant to this Order shall be undertaken in accordance with the requirements of all applicable federal, state, and local laws, regulations, permits, and ordinances.

80. Compliance by Respondents with the terms of this Order shall not relieve Respondents of their obligations to comply with RCRA, or any other applicable federal, state, or local laws, regulations, permits, and ordinances.

81. This Order is not and shall not be interpreted to be a permit, or as a ruling or a determination of any issue related to a permit, under federal, state or local law; nor shall this Order in any way affect Respondents' obligations, if any, to secure such a permit; nor shall this Order be interpreted in any way to affect or waive any of the conditions or requirements that may be imposed as conditions of such permit or of Respondents' rights to appeal any conditions of such permit. Respondents shall obtain or cause their representatives to obtain all permits and approvals necessary under such laws and regulations.

XVI. OTHER CLAIMS

82. Nothing in this Order shall constitute or be construed as a release from any claim, cause of action, demand, or defense in law or equity, against any person, firm, partnership, or corporation for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release, or disposal of any hazardous waste constituents, hazardous substances, hazardous wastes, pollutants, or contaminants found at, taken to, or migrating from the facility.

83. By issuance of this Order, the United States and EPA assume no liability for injuries or damages to persons or property resulting from any acts of omissions of Respondents or their agents, contractors, subcontractors or other representatives.

84. Neither the United States nor EPA shall be a party or be held out as a party to any contact entered into by the Respondents or their directors, officers, employees, agents, successors, representatives, assigns, contractors, or consultants in carrying out activities pursuant to this Order.

XVII. SUBSEQUENT MODIFICATION OF ORDER

85. Except as provided in paragraph 86, this Order may only be modified by written amendment signed by the Branch Chief or the Regional Administrator, EPA, Region 5.

86. Modifications in any schedule adopted pursuant to this Order may be made in writing by EPA's Project Coordinator.

87. No informal advice, guidance, suggestions, or comments by EPA shall be construed to modify the requirements of this Order. Routine communications exchanged verbally, in person or by telephone, between the parties to facilitate the orderly conduct of work contemplated by this Order shall not alter or waive any rights and/or obligations of the parties under this Order.

XVIII. STATEMENT OF SEVERABILITY

88. If any provision or authority of this Order, or the application of this Order to any party or circumstances, is held by any judicial or administrative authority to be invalid, the application of such provisions to other Parties or circumstances and the remainder of the Order shall not be affected thereby.

XIX. TERMINATION AND SATISFACTION

89. Respondents may seek termination of this Order by submitting to EPA a written document which indicates the respective Respondent's compliance with all requirements of this Order, and the associated dates of approval correspondence from EPA. The provisions of this Order shall be deemed satisfied upon Respondent's and EPA's execution of an "Acknowledgment of Termination and Agreement for Record Preservation and Reservation of Rights" (Acknowledgment). The Acknowledgment shall specify that Respondent has demonstrated to the satisfaction of EPA that the terms of this Order, including any additional tasks determined by EPA to be required pursuant to this Order, have been satisfactorily completed.

90. The provisions of this Order shall be deemed satisfied upon Respondent's receipt of written notice from EPA that Respondent has demonstrated to the satisfaction of EPA that the terms of the Order, including any additional tasks determined by EPA to be

required pursuant to this Order, have been satisfactorily completed. This notice shall not, however, terminate Respondent's obligations to comply with any continuing obligations hereunder, including without limitation, Section XII (Record Preservation), XIV (Reservation of Rights), XV (Other Applicable Laws).

XX. OPPORTUNITY TO CONFER

91. In accordance with Section 3013(c) of RCRA, 42 U.S.C. § 6934(c), Respondents or their representatives may confer in person or by telephone with EPA regarding this Order. The opportunity to confer with EPA may be pursued by the Respondents either before or after the proposals are due, but not later than sixty (60) days after the issuance of this Order. At such conference, Respondents may discuss the following with EPA: the Order, its applicability to the Respondents, the correctness of any factual determinations upon which the Order is based, the appropriateness of any actions which Respondents are hereby ordered to undertake, and any other relevant and material issue.

92. The scheduling of a conference with EPA does not relieve Respondents of the obligation to submit the written proposals required under Section VI of this Order within thirty (30) days of the date of issuance of this Order, or to implement the proposals once approved, or approved with modifications, by EPA.

93. At the conference described above, Respondents may appear in person and/or by attorney or other representative. Additionally, Respondents may submit written comments to the EPA Project Coordinator addressing issues that could be raised in the conference within the time frames set for conducting such conference.

94. Any request for a conference with EPA, and other questions regarding this Order should be directed to:

Christine Liszewski
Associate Regional Counsel
U.S. Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Chicago, IL 60604
(312) 886-4670

If Respondents fail to request a conference within the time periods provided in this Section, or fail to agree upon a date to schedule such conference within the time periods provided in this section, Respondents shall be deemed to have waived their rights under Section 3013 of RCRA to confer with EPA regarding this Order.

XXI. POTENTIAL CONSEQUENCES OF FAILURE TO COMPLY

92. In the event Respondents fail or refuse to comply with the terms and provisions of this Order, EPA may commence a civil action in accordance with Section 3013(e) of RCRA, 42 U.S.C. § 6934(e), to require compliance with such Order and to assess a civil penalty (consistent with 40 CFR Part 19) not to exceed $5,500 for each day during which such failure or refusal occurs.

93. If EPA determines that Respondents are not able to conduct the activities required by this Order in a satisfactory manner, or if actions carried out are deemed unsatisfactory, then EPA or its representatives may conduct such actions deemed reasonable by EPA to ascertain the nature and extent of the hazard at the property and/or facility of Respondents. Respondents may then be ordered to reimburse EPA or its representatives for the costs of such activity pursuant to Section 3013(d) of RCRA, 42 U.S.C. § 6934(d).

XXII. EFFECTIVE DATE/DATE OF ISSUANCE

94. The effective date of this Order is the date it is signed by the Branch Chief. The date of issuance of this Order shall be the same date as the effective date.

IN THE MATTER OF
ISG INDIANA HARBOR INC.
AND
TECUMSEH PROPERTIES INC
3001 DICKEY ROAD
EAST CHICAGO, INDIANA
IND 005 462 601

IT IS SO ORDERED

for Joseph Boyle, Chief
Enforcement & Compliance Assurance Branch
Waste, Pesticides and Toxics Division
U.S. Environmental Protection Agency/ Region 5

October 23, 2003
Date

RECEIVED
REGIONAL HEARING
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US ENVIRONMENTAL
PROTECTION AGENCY
REGION V

TABLE I-1

List of SWMUs

SWMU	SWMU Name
1	Blast Furnace Filter Cake Pile
2	Sinter Plant Cyclone
3	Sinter Plant Precipitator
4	Outfall 009
5	Outfall 010
6	Sinter Plant Scrubber
7	"The Hill"
8	Terminal Lagoon
9	Oil Skimmer Tank
10	Terminal Lagoon Sludge Pit
11	Ladle Metallurgy Facility Baghouse
12	Bosch Tank Drain Clarifier Sludge Roll-Off
13	Outfall 011
14	Reladle Desulfurization Baghouse
15	Basic Oxygen Furnace
16	Refuse Pile Near Basic Oxygen Furnace
17	Basic Oxygen Furnace Precipitator and Ash Output
18	Levy Operation Slag Piles
19	Oil Recovery Unit
20	Clark Materials Landfill
21	No. 1 Scale Pit
22	No. 2 Scale Pit

49	Titzel Used Oil Reclamation Unit
50	No. 2 Tin Mill Waste Chromic Acid Tank
51	No. 2 Tin Mill Sulfuric Acid Spillage
52	Safety-Kleen Parts Washers
53	Used Crankcase Oil Tank and Container Storage
54	Laboratory Waste Accumulation
55	Slab Scarfer Scrubber
56	PCB Storage Area
57	Asbestos Waste Roll-Off
58	Old Lead Baghouse Site
59	Container Storage Area
60	Grit Blast Baghouse
61	Wastewater Treatment Plant Waste Pickle Liquor Storage Tank
62	Chemical Waste Management Roll-Offs
63	Chemical Waste Management Roll-Offs
64	Chemical Waste Management Roll-Offs
65	Coke Plant Decanter Site
66	No. 1 Tin Mill Demolition Rubble Piles
67	Sinter Plant
68	Sinter Plant Feedstock Piles
69	No. 2 Tin Mill Waste Sodium Dichromate Tank Sump
70	No. 2 Sheet Mill Spent Pickle Liquor Tank Sump
71	Blast Furnace Demolition Rubble Piles
72	Cleanup Wastes Staging Area
73	Old Quenching Area
74	Lakefill Area

TABLE I-2

List of AOCs

AOC	AOC Name
A	Titzel Unit Oil Spillage Area
B	Scrap Metal Cutting Area
C	Fuel Oil Spill Area
D	Leaking Underground Fuel Oil Tank(s) Remediation Area
E	Leaking Underground Coating Oil Tanks(s) Remediation Area